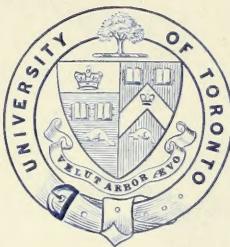


# PROGRESSIVE MEDICINE

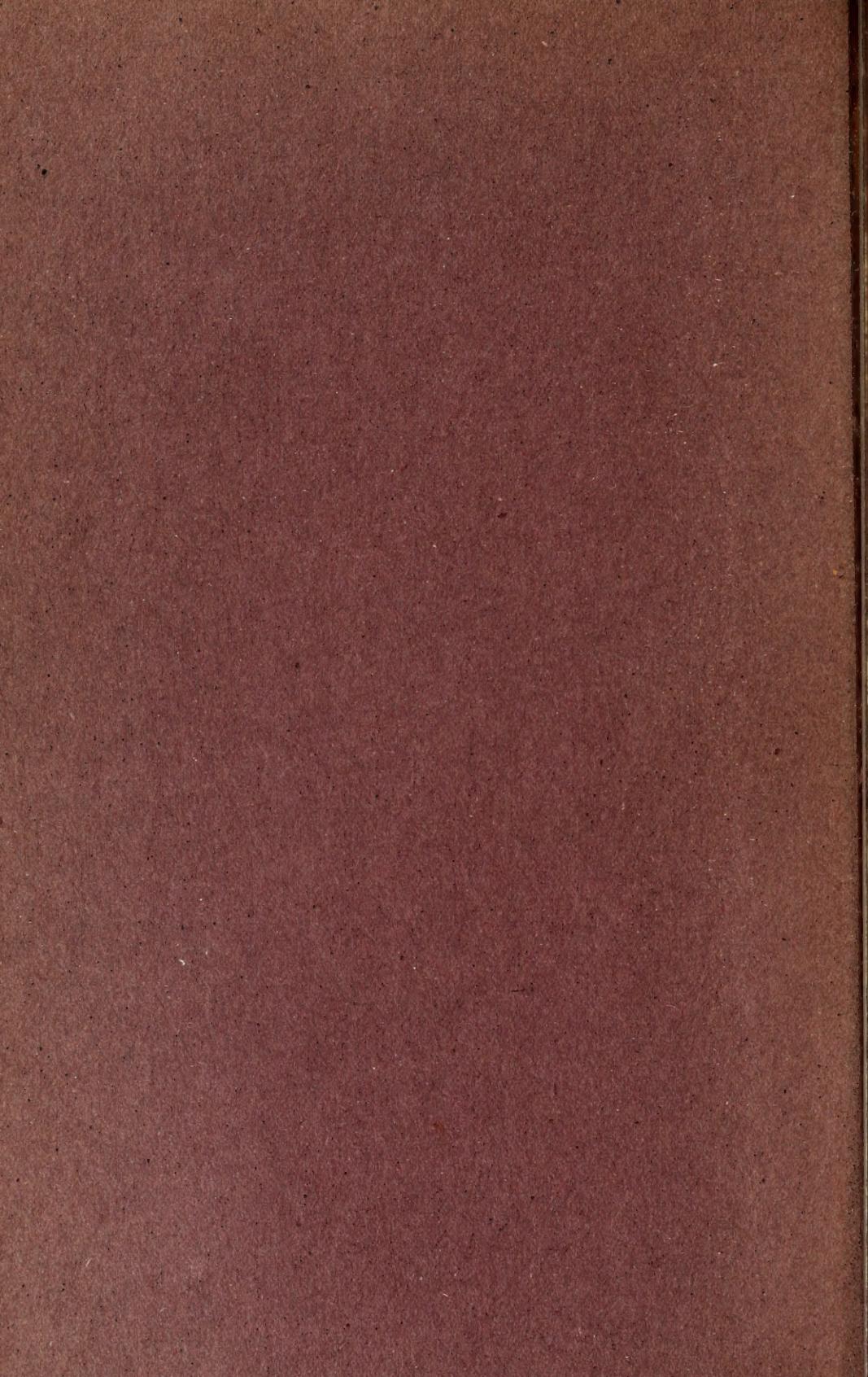


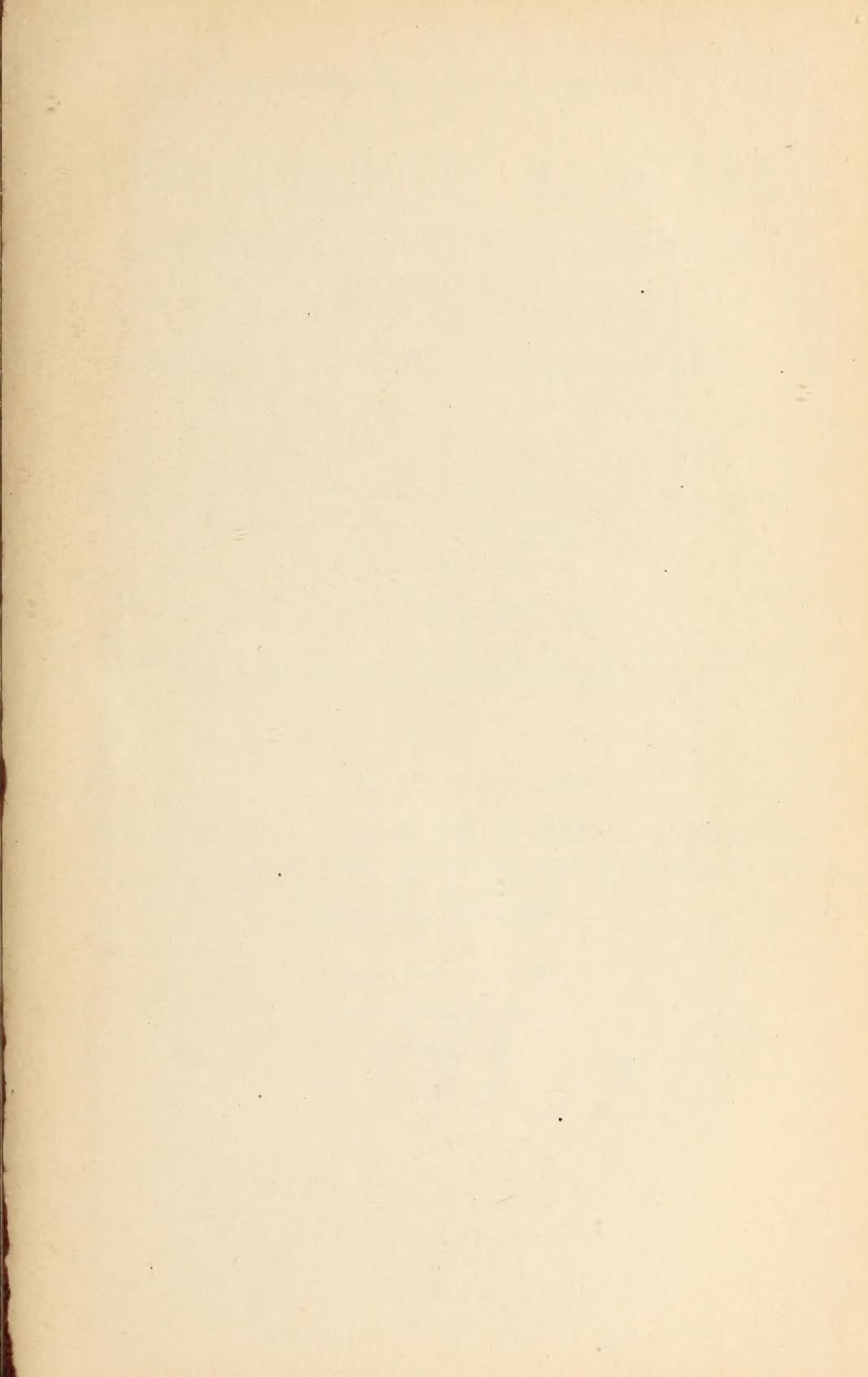


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Awarded Grand Prize, Paris Exposition, 1900

# PROGRESSIVE MEDICINE

A QUARTERLY DIGEST OF ADVANCES, DISCOVERIES  
AND IMPROVEMENTS

IN THE

## MEDICAL AND SURGICAL SCIENCES

EDITED BY

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VOLUME II. JUNE, 1916

HERNIA—SURGERY OF THE ABDOMEN, EXCLUSIVE OF HERNIA—GYNECOLOGY—  
DISEASES OF THE BLOOD. DIATHETIC AND METABOLIC DISEASES.  
DISEASES OF THE SPLEEN, THYROID GLAND, NUTRITION,  
AND THE LYMPHATIC SYSTEM—OPHTHALMOLOGY.



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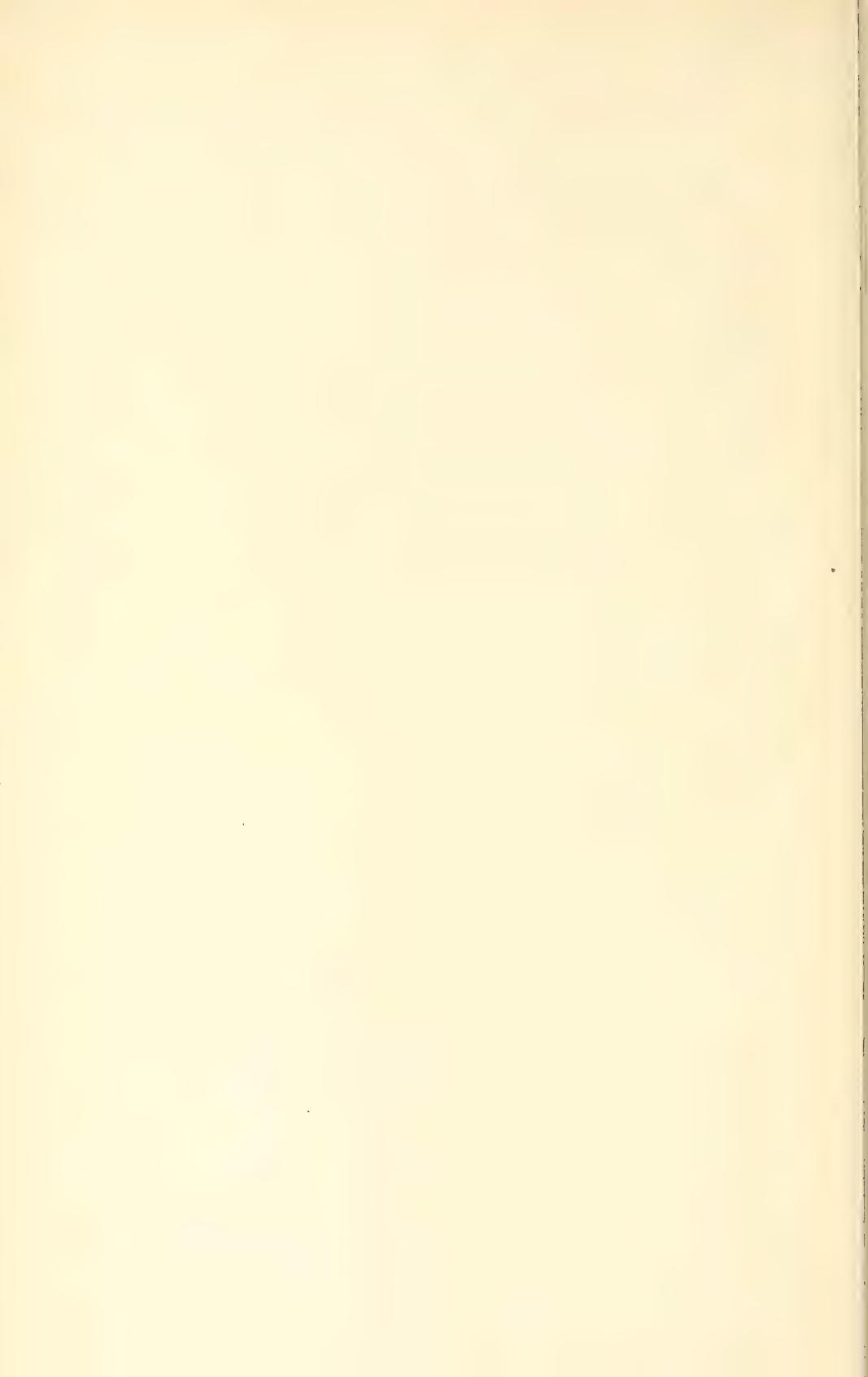
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# PROGRESSIVE MEDICINE.

JUNE, 1916.

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## HERNIA.

BY WILLIAM B. COLEY, M.D.

The Relation of Hernia to the Workmen's Compensation Law was the chief topic of discussion before the meeting of the Medical Society of the County of New York, February 23, 1915.<sup>1</sup> The meeting was opened by Moschcowitz, of New York, who read a very able paper upon the subject. He first gives a brief description of seven different theories or explanations of the cause of hernia.

1. The oldest theory is, that hernia is due to a tearing of the peritoneum, thereby permitting the prolapse of the contents of the abdomen through the defect created; hence, the term "rupture" applied to hernia up to comparatively recent times.
2. Increased abdominal pressure due to external force.
3. The theory of inadequate fixation of the viscera.
4. The saccular theory of a prolongation of the peritoneum into or through the various canals or openings, into which eventually the viscera find their way.
5. The theory of Roser, according to which the hernial sac is dragged out by an outward growth of a lobule or properperitoneal fat.
6. The congenital theory so strongly advocated by Hamilton Russell, attributing all herniae to a faulty closure of the vaginal process of peritoneum. (Practically the same as No. 4.)
7. The theory accepted by Moschcowitz, is, that "a hernia is a protrusion of an intra-abdominal viscous into a preformed sac of peritoneum." He states, "If this theory is correctly scrutinized, it will be found that the only essential part of a hernia is the sac. I am sure it does not require any lengthy argument to prove my contention, but I may be permitted to prove it by a simple example. An individual in the erect position has a hernia which is composed of two parts, namely, hernial sac, plus hernial contents; he now lies down and the contents are

<sup>1</sup> Medical Record, April 3, 1915.

reduced; he, of course, still has his hernia, although there are no contents within the sac. The same is true of an individual who retains his hernial contents by a truss. The sac being an essential *sine qua non*, it is incumbent upon us to carefully analyze the mechanism of the formation of the sac."

Moschcowitz states that the important part in the pathogenesis of hernia is the formation of the sac; and that the location of the hernia is entirely accidental, being proscribed by certain weak anatomical areas in the intra-abdominal fascia.

He believes that the process just described is a true, though crude, outline of the manner in which an ordinary hernia is, as a rule, acquired. In addition, there exist a number of other factors which predispose an individual to the acquisition of a very common form of hernia, namely, the *inguinal*.

Among these *contributive causes*, Moschcowitz mentions the following:

1. Certain anatomical peculiarities of the inguinal region.
2. The direction of the inguinal canal.
3. Varicocele and veins.
4. Mobility of the peritoneum.
5. The usually erect position of the human race.
6. Hypoplasia of the tissues.

In discussing *traumatic hernia*, Moschcowitz cites some of the different forms, *viz.:*

1. Herniae which follow a clean laparotomy wound, due to various causes, such as imperfect suturing, improper suture material, and post-operative vomiting.
2. Laparotomy incisions in which an infection has occurred.
3. Laparotomy incisions which require drainage.
4. Excisions of the abdominal wall in which it is impossible to perform adequate suture.
5. Cases in which the abdominal wall is directly injured by some more or less pointed object, *e. g.*, running or falling against a protruding object, causing more or less laceration of the abdominal walls, permitting the protrusion of the intra-abdominal contents.
6. Cases in which individuals fall from a height. Such a fall may produce involuntary and reflex contraction of the abdominal muscles, generally the recti, "that they and their fascia are completely torn through, with a resulting hernia."
7. "Penetrating or non-penetrating injuries of the thorax, with injury of the diaphragm, are frequently followed by traumatic diaphragmatic herniae."

Personally, I do not agree with Dr. Moschcowitz in contention No. 6, that a fall from a height, causing reflex contraction of abdominal muscles, especially the recti, may produce a hernia. No such case has ever been observed at the Hospital for Ruptured and Crippled to my knowledge.

Moscheowitz believes the question may with propriety be asked: "Are there any definite criteria which characterize a traumatic hernia?" In reply, he states that the question is a debatable one from the viewpoint of the afflicted individual and from the viewpoint of established medicine.

Moscheowitz states that "the patient who notices a swelling in either inguinal region usually sooner or later consults a physician. Upon inquiry, particularly if a claim is in view, he is frequently able to set a definite time for the appearance of the hernia, and to recollect some definite effort, so-called 'überheben' of the German, or 'strain', during which the hernia first made its appearance. If my pathogenesis of an acquired hernia is correct, it must be patent to everybody that the history as given by the patient is unreliable and not worthy of credit. It is most probable that the sac of this hernia has been long in formation, and that, though small in size it was present for a long time, only unnoticed by the patient. Most frequently the patient notices the hernia only when it has escaped through the external ring and has made a palpable swelling."

Moscheowitz emphasizes the important point, that the patient may be entirely honest in the belief that his hernia was due to a certain cause or certain accident, and yet, as a matter of fact, such cause or accident played no part in its etiology. He further states that "the sudden acquisition of pain in the inguinal region, which had not existed previously, is of little value as an argument in favor of the traumatic origin. This pain may be due to a simple stretching of the sac, following a sudden descent of additional hernial contents into the sac."

Moscheowitz states that the views of unbiased medical men are practically in accord with the views he has set forth. In legal decisions, however, there is far less unanimity. Most of the cases are tried before juries and a great variety of verdicts have been rendered. One of the most recent, and, according to Moscheowitz, faulty decisions was that of the Supreme Court of the State of Washington, which reads as follows:

"Sustaining of an injury while using extreme muscular effort in pushing a heavily loaded truck is as much within the meaning of accident even as though the injury was the result of a fall or the breaking of the truck. To hold with the commission that if a machine breaks, any resulting injury to a workman is within the act, but if the man breaks, any resulting injury is not within the act, is too refined to come within the policy of the act as announced by the Legislature in its adoption and the language of the court in its interpretation."

Moscheowitz's conclusions are:

1. Traumatic hernia is exceedingly rare.
2. Traumatic hernia may occur in any part of the abdomen, but usually not at the site of the normal hernial openings.

3. Non-traumatic hernia is frequent and occurs at certain definite and predestined locations caused by weak areas in the intra-abdominal fascia.

4. Workmen's compensation commissions are not and cannot be acquainted with all the facts relating to hernia. This is evidently the sphere of the medical profession; and workmen's compensation commissions should be required to place implicit reliance in these matters upon the decisions of established medicine.

5. In cases of appeal from the decision of the commission, all the medical part of the testimony should be given by experts of the court's selection and not of the selection of the claimant or defendant.

**Traumatic Hernia.** There is still a wide difference of opinion upon the subject, both in the minds of the medical and legal profession. The subject was an important topic of discussion at the twentieth annual meeting of the Chicago and St. Paul Railroad Association, Chicago, December 18, 1913.<sup>1</sup>

Bouffleur, of Chicago, states "the subject of traumatic hernia is of vital importance, the interest in which can only be adequately appreciated when one takes into consideration the fact that such organizations as the government insurance society in Berlin, and the similar one in England, have been wrestling with the subject for years, in fact nearly ever since those organizations were formed." He states that now, "when the matter of State insurance and the various employers' liability acts are being put into force, the subject is being given much broader attention on behalf of the public, than heretofore." He calls attention to the fact that some of the older writers, especially the German, considered traumatic hernia one of the rarest conditions to be met in emergency surgery. The German insurance companies, in the case of a traumatic hernia, pay 10 per cent. of the earning power; for the loss of a finger they pay 7 to 8 per cent.; for the loss of a limb, 20 to 25 per cent.

Golebiewski, chief surgeon of the German "Berufsgenossenschaft," who has written a book on the workings of this society, states that he has seen only two cases of real traumatic hernia.

Under traumatic hernia, Bouffleur includes not only herniae due to local trauma, and external violence, but also indirect traumas, such as the application of force to the abdominal wall from within; in other words, herniae due to increased abdominal pressure. He states that personally he holds to the idea that a hernia which occurred as the result of a trauma or strain would be known by the individual immediately. If it were congenital, with a patent canal, it could occur without his knowing it perhaps, but, if the canal is relatively normal and it is suddenly forced open, there is sufficient laceration, tearing and distortion of the tissues, to call the individual's attention to it immediately;

<sup>1</sup> Railway Surgical Journal, August, 1914, xx, No. 12, p. 421.

in all probability he would be somewhat nauseated; but, in any event, he would know that something had occurred of sufficient consequence to demand attention.

One of our western States has taken the view that a man who has a hernia, not of congenital type, but due to an immediate accident, will know it at the time and will call attention to it; it is thought inconceivable that any force sufficient to produce a hernia would not make him nauseated or give him such acute pain that he would quit work for a few minutes, or certainly that he would call someone's attention to it. With laceration of tissues, there is ecchymosis. Bouffleur states that an act of this sort, which is accompanied by pain and followed even within four to five days by a little ecchymosis over the external ring, in his opinion, presents sufficient evidence to warrant us in saying that there was laceration of tissues in that part of the wall, as evidenced by the ecchymosis, and if such did occur, and a hernia was present, it would seem to be pretty conclusive that the act was a factor in producing the protrusion. In an experience of twenty-six years at the Hospital for Ruptured and Crippled, at which nearly 5000 cases of hernia a year are treated, I have never seen a patient presenting such evidence. Further, I do not believe that a single increase in intra-abdominal tension due to an accident or strain can produce a hernia.

The Northern Pacific Railroad holds that a hernia which appears shortly after a man enters the service and becomes entitled to benefits, must have some definite evidence of being of recent occurrence, such as localized pain, or faintness or nausea, with localized evidence of trauma appearing within the week, or, upon operation, there must be some evidence that it is of recent origin.

The legislators of some of the States, however, have come to a much broader interpretation of the term "traumatic hernia." Some have passed a form of insurance, an employers' liability act, in which a commission ruled, *e. g.*, in a mining business, that all herniae appearing during labor, are necessarily traumatic. If such a ruling is accepted, great injustice will be done to insurance organizations, employing companies, and corporations. They show the very great importance of clarifying our ideas upon the nature and causes of traumatic hernia, I believe that most of the railroads which have adopted a system of physical examination of new employees have, for years, made very careful examination with regard to the presence of a hernia. If a hernia is discovered, the applicant is not accepted until he has had a radical operation. This prevents later claims for a hernia which had existed for a long time, often without the knowledge of the employee.

Bouffleur strongly endorses the German position, that the trauma, the force applied at the time, is the means of discovery and not the cause of the hernia. From a legal standpoint, it is not necessary for a man to be perfect: the question that comes before the court is: was he damaged

at the time, or was his condition aggravated by the injury? If so, then it is regarded as a traumatic case, or a "hernia of effort." Bouffleur cites, as an example, the case of a man in apparent good health who did not know he had a hernia; "in some accident, wreck, or otherwise he is injured, receives contusions, and a hernia is present. Every court in the land would rule that the railroad company would have to pay for that hernia—they will not take into consideration the fact that he may have had an open canal there before, but they take into consideration the fact that the accident itself produced the manifestation of hernia. The only way I know of that the railroad company or any corporation or even State insurance organization, can get out from under this ruling, is to prove that the man *knew* he had a weakness or hernia there before. As long as the man says he did not know he had a hernia, and we cannot prove that he did know, you will find that the responsible party will have to pay for the damage done."

I believe that Dr. Bouffleur goes too far in the statement just quoted. The important point is not whether the man *knew* he had a hernia before, but whether he actually *had* it. Our experience at the Hospital for Ruptured and Crippled has proved that very frequently a patient comes to the hospital for the treatment of a hernia on one side which he has recognized, and careful examination by the surgeon reveals the presence of another hernia, nearly, if not quite, as large as on the other side, of the existence of which the patient had no knowledge. This proves that a man may have a hernia for a long period, without any knowledge of its presence. If such an individual meets with some local injury, or some accident causing increased intra-abdominal pressure, and immediately thereafter notices for the first time that he has a hernia, he will naturally and perfectly honestly, though altogether erroneously, regard the accident or injury as the cause of the hernia. With the statement that Dr. Bouffleur makes that every court of the land would rule that the railroad company would have to pay for the hernia in such a case, I by no means agree. In the first place, in this country at least, as far as I know, these matters are never decided by the court, but by a jury. My own experience has been that in the case of the alleged sudden appearance of a hernia, in the absence of any definite clinical symptoms, such as severe local pain, shock and nausea, or evidence of local trauma,—a hernia which, in the opinion of an expert must have existed long before the accident in question occurred—the jury has in almost every instance refused to give damages to the plaintiff. Granting the truth of the now generally accepted opinion, that practically all so-called traumatic herniae occur in persons subject to congenital weakness in the shape of an enlarged ring or open preformed sac, there remains the important question: Did the person have an actual hernia before the injury or accident in question. If, at the first examination shortly after the accident, we find a large scrotal hernia without tenderness or

evidence of local trauma, and the claimant had no pain nor nausea nor evidence of shock at the time of the accident, we can be practically certain that the hernia existed before the accident, and is entirely independent of it. Coming to the second question, one that is far more important, and has given rise to more dispute in a medicolegal way than any other, whether a hernia might be caused by a single increase in intra-abdominal pressure: MacCready, the greatest English authority on hernia, states that an acquired hernia is never due to this cause. Graser, one of the highest German authorities, states that a hernia complete in all its parts could never arise at the moment of accident, or by a single increase in the intra-abdominal tension, be it ever so great. With some railroads this problem has been partially settled by careful physical examination of their employees, but, with most roads, this examination has not been extended to cover the cases of ordinary laborers. In some roads, 35 per cent., or more, of the employees are track men who are not subjected to any examination at present.

**Radical Cure of Hernia.** While BASSINI'S OPERATION has been described so often and almost universally adopted, few are probably familiar with Bassini's personal technic. In the discussion of a paper on inguinal hernia by Hebley,<sup>1</sup> Dr. Judd gave some personal reminiscences of a visit to Bassini's clinic, seven years previously. He recalls the fact that Bassini has long been professor of surgery at the University of Padua, one of the most famous universities of Europe, where the same amphitheatre from which Fabricius and Paracelsus lectured, may still be seen. Dr. Judd's description of Bassini's clinic takes one back to the early days of antiseptic surgery. He operates in an antiquated room; the patient is brought in entirely naked, put upon the table, and is then covered with a rubber sheet. Not a single towel is used in the entire operation, only rubber sheets taken from an antiseptic solution, no catgut or absorbable suture is used, only silk. Judd states the place reeks in antiseptics, floors are wet and cold. As a final torture, the poor patient is encased in plaster of Paris from the arm-pits to the ankles, and "should get well, if he does not get pus." The plaster is kept on for four weeks.

It would seem from this description that the followers and imitators of Bassini have made some improvements upon the brilliant operation introduced by Bassini in 1890.

The disadvantages of the silk suture, or non-absorbable suture, have already been so frequently pointed out in previous numbers of PROGRESSIVE MEDICINE that I will merely allude to them here. The substitution of absorbable sutures, such as kangaroo tendon or chromicized catgut, which, under modern methods, can be completely sterilized, in spite of the opinions recently advanced to the contrary, constitutes,

<sup>1</sup> Medical Society of Hawaii, Honolulu, 1914, pp. 23, 71, 78.

I believe, one of the greatest improvements of the original Bassini operation. With regard to the use of plaster of Paris, we adopted the use of a plaster spica in children up to the age of fourteen years at the Hospital for Ruptured and Crippled, in 1889, before Bassini's paper was published. We have continued this step in the technic of the after-treatment up to the present time, except that we have in recent years gradually reduced the age limit, seldom using it now in children over the age of ten to twelve years. In adults and older children which can be depended upon to keep reasonably quiet after operation, we believe the plaster cast is unnecessary. In no case do I think it necessary or wise to encase the whole body from the axilla to the ankle in plaster of Paris.

As regards the duration of the after-treatment, most surgeons, in recent years, have allowed their patients to get up at the end of two to two and a half weeks, instead of keeping them in bed for four weeks, as still advocated by Bassini. That the shorter period in bed is sufficient to produce permanent good, has been fully proved by large statistics.

LOCAL ANESTHESIA IN OPERATIONS FOR HERNIA. At the meeting of the American Association of Obstetricians and Gynecologists at Pittsburg, September 19, 1915, Jacobson, of Toledo, strongly advocated the further extension of local anesthesia in operations for hernia, and reported 96 additional operations performed under local anesthesia, which added to his previously published series gives a total of 125 cases thus operated upon by him, without deaths. Of these 97 were for the radical cure of inguinal, 6 for strangulated inguinal hernia; 7 for the radical cure of femoral hernia; 5 strangulated and 3 incarcerated femoral hernia and 3 incarcerated umbilical hernia. He states that further experience has convinced him that whenever possible, such operations should be performed under local anesthesia, the only exception being hernia in children and extremely nervous adults. He states that the preliminary injection of morphin and scopolamin usually allays all nervousness, and the operation can be carried out, even in nervous patients, with the same facility as under general narcosis. In only 3 cases was it necessary to complete the operation with a small amount of ether. The different objections that have been raised to local anesthesia, he states, have been psychic disturbances; pain during operation; inability of the surgeon to do complete work; greater danger of infection; prolongation of the operation as compared with general anesthesia. He believes that all these objections can be satisfactorily answered.

As regards the greater danger of infection, he states that he has had only one infection, and this was due to faulty preparation of the solution.

In regard to the prolongation of the operation, he states that with the newer technic the injection and anesthetic effect take less time than is required to put the patient asleep with ether, and, as to the time

consumed in the operation, there is no difference between local and general anesthesia. He advises using two points of injection, the first opposite the anterior superior spine of the ilium and the other about an inch above the spine of the pubes, for inguinal hernia. In this way the skin line of incision can be rendered painless. He states that he has entirely abandoned the separate infiltration of the inguinal nerves, as done in the earlier operation, as they seem to be sufficiently anesthetized by the solution deposited under the external oblique. He never observed any toxic effect from the use of the  $\frac{1}{2}$  per cent. novocain and adrenalin solutions. The average amount of solution employed has been from 3 to 6 ounces, depending upon the size of the hernia. He believes an accurate hemostasis essential to success.

In consideration of the great frequency of hernia, estimated on an average of 1 : 22 in both sexes, and the still by no means inconsiderable mortality resulting from strangulated hernia, he believes that operation should be far more generally done. He cites the statistics as regards death from hernia in the United States as follows: In 1910, 2192; in 1911, 2369; in 1912, 2348; in 1913, 2424, placing the mortality rate per 100,000 not far from 4.

In view of this, it would seem justifiable to advise an operation, which has been proved to be practically free from mortality, in all patients suffering from hernia in whom there are no contra-indications to operation. When the medical profession become convinced that the operation for the radical cure of hernia has been rendered practically free from mortality, and affords an almost certain chance of a complete cure, truss treatment will be given up or reserved for special cases in which there is contra-indication to operation.

Nearly every year the INTERNAL CLOSURE OF THE FEMORAL OPENING, or the inguinal operation for femoral hernia, the objections to which have frequently been presented in PROGRESSIVE MEDICINE, appears to find new advocates. Briggs,<sup>1</sup> of Cleveland, O., in a paper read before the Surgical Section of the Ohio State Medical Association at Columbus, Ohio, May 5, 1914, strongly urges the operation as superior to the older methods of closing the ring externally. Like most of the men who have urged this method of operation for femoral hernia, he starts out with the assumption that operations for femoral hernia have never been as efficient or satisfactory as those for inguinal hernia. He brings up the argument so frequently used, that no better evidence that the older operations are unsatisfactory could be mentioned than the published records of nearly a hundred different operations for this one condition. One might as well cite the fact that one hundred different operations have been performed for inguinal hernia, many of them since Bassini's operation was brought out in 1890, as evidence against the efficiency

<sup>1</sup> Ohio State Medical Journal, 1914, x, 662.

of Bassini's operation, and claim that, therefore, we are in need of a new one.

Briggs does not claim originality for the operation, although he states that when he first did it, ten years ago, he did not know that it had been performed by other surgeons.

It is unnecessary to dwell upon the technic of the method, as that has been frequently described in previous numbers of PROGRESSIVE MEDICINE. The arguments offered in favor of the method by Briggs, and others, are that "its application possesses a manifest advantage over the external operation in dealing with the sac, in that it is assumed to be quite impossible, by the latter method, to eliminate the sac even with the parietal peritoneum, and a funnel-shaped projection probably nearly always persists which plays a most important predisposing factor in recurrence." Furthermore, that "closure of the femoral opening is more advantageously done from above for several reasons. In closing the opening from below, there is encountered the shelving projection downward of Poupart's ligament with Cooper's ligament at the apex of a rather deep reentrant angle which is extremely difficult and probably rarely accomplished as an actual fact. All that it is probably possible to accomplish, with rare exceptions, is a suture of Poupart's ligament to the pecten muscle and its fascia directly posterior, a distance of about a centimeter below Cooper's ligament. This closure leaves a pocket at the femoral opening which invites subsequent protrusion. The closure from above allows ready approximation of the margins of the opening, drawing Poupart's ligament upward, as well as backward, to Cooper's ligament, and effects a closure even with the edge of the pelvis, avoiding the pocketing mentioned."

Referring to the criticisms that have been made about the method, Briggs states it has been claimed to be a more formidable and exacting procedure than the external operation. He believes, however, that the "precision, efficiency and visual safety with which it can be done, far outweigh the disadvantages mentioned." Another disadvantage pointed out is that the tension exerted in closing the femoral opening from within might weaken the external abdominal ring, favoring the occurrence of inguinal hernia, but the frequency with which femoral and inguinal hernia exist on the same side is quite sufficient, he thinks, to bring any such cases within the range of reasonable coincidence.

My objections to the inguinal operation for femoral hernia have been so frequently stated in previous issues of PROGRESSIVE MEDICINE, that I will only briefly outline them again:

The first objection is that the internal operation is based on the false assumption that the external operation is unsatisfactory, and that the results are not as good as in inguinal hernia. Our own statistics, at the Hospital for Ruptured and Crippled, given in the present number of PROGRESSIVE MEDICINE, show that the results in femoral hernia are

practically as good as in inguinal hernia, in fact they are as nearly ideal as one can reasonably hope for from any method of operation. A second criticism is, that all of the advocates of the internal operation have failed to produce any statistics which give one reason to believe that the results are better, or even as good as those obtained from the external operation. In fact, Briggs concludes his paper with the statement that his own cases have been under observation but a short time.

If, then, the far simpler operation gives practically ideal results, I see no reason to abandon it and substitute the operation which every one must admit is much more difficult to perform and connected with greater risk.

While my own objections to the inguinal method for femoral hernia are based largely upon clinical data, more recently very strong anatomical objections have been furnished by Thomas, of Philadelphia, in his Anatomical Study of Femoral Hernia.

T. Turner Thomas,<sup>1</sup> of Philadelphia, presented an interesting ANATOMICAL STUDY OF FEMORAL HERNIA before the Philadelphia Academy of Surgery, May 3, 1915. In addition, he reported several rare cases of hernia recently observed at the Philadelphia Hospital.

The first was a case of *inguinal hernia*, with partially descended testicle, and vaginal process closed only at internal ring. The patient was a man, aged forty-five years, operated on in February, 1914, in the Insane Wards at the Philadelphia Hospital. It is stated that the hernia was the size of a closed fist, reducible, direct, and the testicle on that side was a little below the external ring. After opening what appeared to be the sac of the hernia, it was found empty, and the finger did not pass into the peritoneal cavity, but was arrested at the internal ring. Below, the testicle projected into it. The hernia was behind it, and the sac separated from it by loose areolar tissue. Thomas states "we had here a so-called infantile congenital hernia in which one must cut through three layers of peritoneum before reaching the contents of the hernia, the first two being those of the unobliterated vaginal process and the third being that of the hernial sac." The vaginal process in this case was divided just above the testicle, the upper part removed, and the lower part closed.

The description in this case is not entirely clear. The statement that the hernia was direct raises some doubt, inasmuch as in our experience, at the Hospital for Ruptured and Crippled, no case of undescended testis has ever been found associated with a direct hernia. We have had, however, a considerable number (65) of cases of the so-called inguino-superficial variety of hernia, which condition could easily simulate that described by Thomas. In this type of hernia the upper and empty portion of the sac which is separate, rests upon the aponeurosis of

<sup>1</sup> Annals of Surgery, November, 1915.

the external oblique, so that if one cuts directly down to the sac, one would have to go through three layers of peritoneum, two layers of the pouch resting upon the aponeurosis and then the layer of the sac, but, in order to reach this layer, one would always have to cut through the aponeurosis of the external oblique. This condition, if it reached the size of a closed fist, as in the case of Thomas's, might easily simulate a direct hernia, but the chances would be very great that the sac came out of the internal ring, and not internal to the deep epigastric artery, as would be the case in a direct hernia. In 281 cases of hernia associated with an undescended testis, operated upon at the Hospital for Ruptured and Crippled, and a large number which I have operated upon elsewhere, we have observed only three examples in which the tunica vaginalis did not have a direct connection with the hernial sac.

I have, however, recently operated upon a case of double inguino-superficial hernia, associated with undescended testis, in which the funicular process had been entirely obliterated and there was no actual hernia on either side. This condition is extremely rare.

Another case reported by Thomas, which has an important bearing upon the dangers of injuring the bladder, is that of a *recurrent, right inguinal hernia*, associated with an overlooked bladder protrusion, and with a *femoral hernia* on the same side. The patient, aged sixty-eight years, had an inguinal hernia of twelve years' standing, which was operated upon in 1907. It recurred three years ago. He also had a femoral hernia on the same side. The operation was performed at the Philadelphia Hospital in March, 1914. The inguinal region was first exposed, and a direct hernial sac found. The femoral hernia was next operated upon through the same external incision. The sac was surrounded by, and adherent to, much fat which was stripped from the sac after opening the latter. In clearing away the fat from the pectenous fascia and muscle, a small opening was made in the wall of the femoral vein. This was closed by a hemostat and a lateral ligature applied. In the inguinal portion of the wound there was much oozing from a mass of fat, which was ligated. An internal hemorrhage appeared shortly after the operation, and, as this was believed to be due to the injury of the vein, only the superficial wound was opened. Twenty-four hours later, the patient had to be catheterized, and five ounces of urine, mixed with considerable blood, were withdrawn. The patient died on the second day. Autopsy revealed a large collection of blood extending from the operative wound to the space of Retzius and deep into the pelvis at the right side, some being found in the peritoneal cavity. There was also a large amount of blood in both pleural sacs, and blood-stained fluid in the pericardial sac. Thomas states that the only explanation is that the ligature, which was supposed to grasp only a mass of fat, encircled a small portion of the bladder which was very vascular. The ligature later probably became loosened and slipped away, thus giving rise to the hemorrhage.

This case illustrates the greater risks that are always attached to secondary operations, inasmuch as the adhesions obliterate most of the anatomical landmarks and render the operation extremely difficult. Both in femoral and in inguinal hernia, I regard the presence of a large amount of fat as a warning of the near presence of the bladder, and believe that too great care about removing this fat cannot be exercised.

Thomas gives an interesting statistic of *bladder hernia*, most of the cases have already been carefully reviewed in previous numbers of PROGRESSIVE MEDICINE. They all show that the diagnosis of bladder hernia is seldom made until the time of operation. In only 2 of Eggenberger's 110 cases, and in 18 of Brunner's 182 cases, was the bladder hernia recognized before operation. In 45 of Eggenberger's 110 cases, the

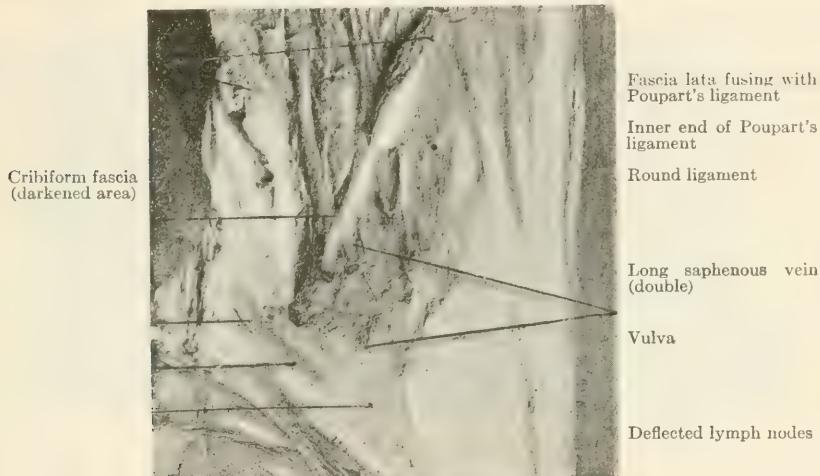


FIG. 1.—Right groin. Skin and superficial fascia removed. Fascia lata fuses with Poupart's ligament and becomes thin (cribriform fascia) where perforated by saphenous vein. Saphenous opening must be made by dissector's knife or scissors. Lymph nodes which covered cribriform fascia have been deflected.

bladder was first recognized during the operation, without being wounded, and only one is reported to have died. In 39 cases in which the bladder was first recognized after being wounded and was then sutured, 3 died. In 9 cases in which the bladder was wounded during operation and overlooked, 4 died, showing a mortality of 44 per cent. in these cases.

Thomas's anatomical studies of femoral hernia are based on a series of dissections made upon formalin-hardened bodies, which, he believes, give a much better idea of the structures in the position occupied in life. In none of the specimens were the veins distended by injection after death.

It is impossible, in the space allotted, to enter more deeply into the anatomical studies made by Thomas, and those who are interested in

the subject are referred to the original paper. He states that the small size and *infrequency of femoral as compared with the inguinal hernia* in all probability is due to the small space through which it must escape from the abdomen and the unyielding margins of the space on three sides. He emphasizes the error, so frequently made by writers on hernia, to assume that the intestine forms a portion of the contents of a femoral hernia almost as frequently as of inguinal hernia. According to Da Costa, the contents of femoral hernia are practically always omentum, very rarely intestine, except in strangulated cases.

Thomas's study has a very important bearing upon the question of the relative value of the internal and external methods of closing the femoral canal in radical cure operations. He states:



FIG. 2.—Regions of inguinal and femoral herniae on both sides of body. On right side fascia lata exposed with removal of cribriform fascia, making saphenous opening. Lymph node resting against femoral ring, but not passing through it as shown in Fig. 5. Portion of external oblique muscle turned inward, leaving Poupart's ligament, internal oblique and spermatic cord in normal positions. On left side fascia lata removed, exposing Scarpa's triangle with its contained structures in normal position. Only Gimbernat's ligament has been touched by paint brush to emphasize absence of any space between it and femoral vein.

"Having had no experience with the method of closing the ring from the inside, through the inguinal canal, I can express an opinion only based on my anatomical study and my experience with the ordinary closure of the ring from the outside. The illustrations showing the ring from the inside (Figs. 3, 4, 5, 6, 7, 8,) demonstrate that its lower boundary is the pubic bone. This is covered only by loose connective tissue and peritoneum. In exposing the ring for the placing of the sutures, most of the overlying connective tissue is pushed away, leaving only the periosteum and a little connective tissue to hold the sutures. I would not trust the needle to pass under the peritoneum without cutting its way out, in which case the suture could have no influence in

closing the ring. On the other hand, the obturator vessels not infrequently come from the deep epigastric and pass to the obturator canal over the internal surface of the ring (Fig. 13). In most other cases,

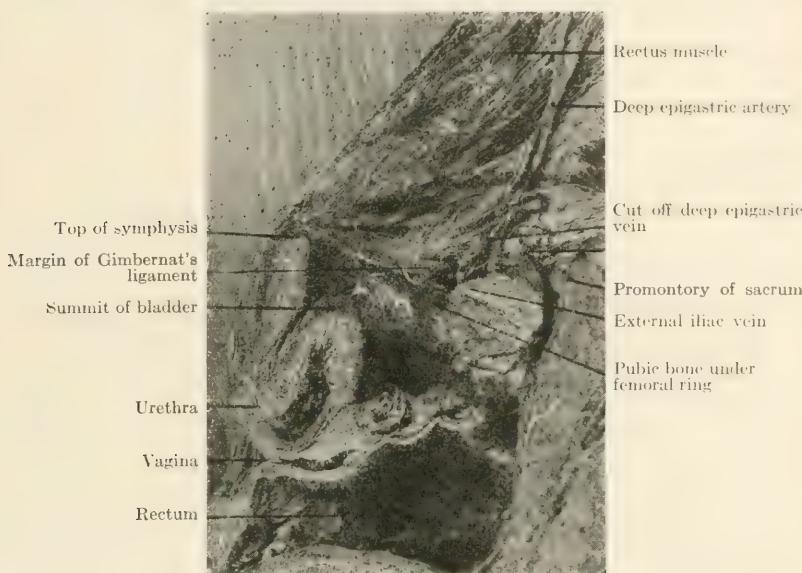


FIG. 3.—View from inside of specimen. Lower boundary of femoral ring now seen to be the pubic bone. Wall of the small femoral vein seems to have fallen away slightly, enlarging the ring still more.

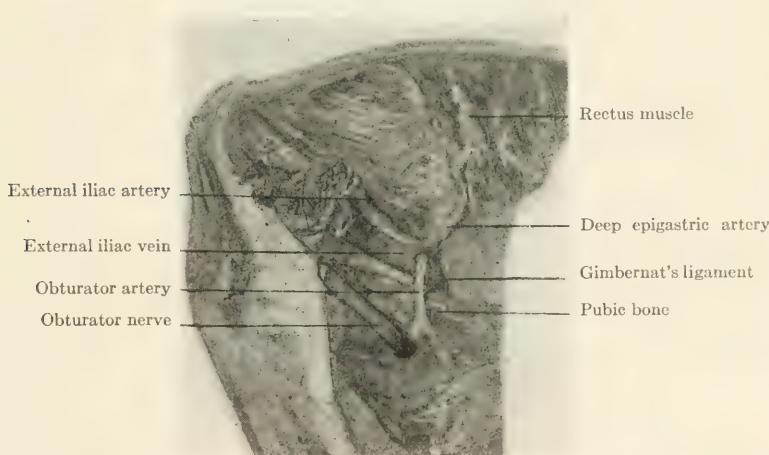


FIG. 4.—Inside view of left half of specimen shown in Fig. 2. Absence of femoral ring again shown by close contact of femoral vein with Gimbernat's ligament. It was particularly difficult to obtain a satisfactory picture of this specimen from the inside. This side has been emphasized slightly by the artist.

pubic branches of the deep epigastric of considerable size have the same general relation to the ring as they pass to the pubic region. There are

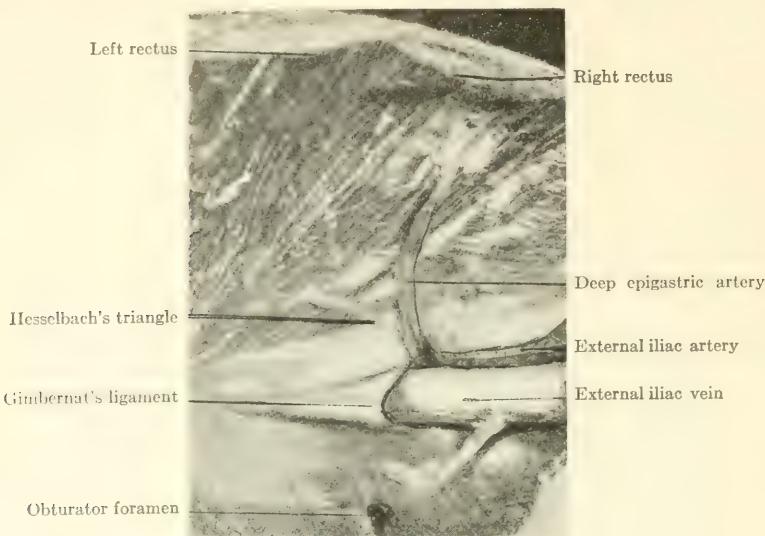


FIG. 5.—Inside view of right half of specimen shown in Fig. 2. Margins of the vessels and Gimbernat's ligament emphasized slightly by the artist. No actual femoral ring here and lymph node seen on this side in external view (Fig. 2) not seen on inside.

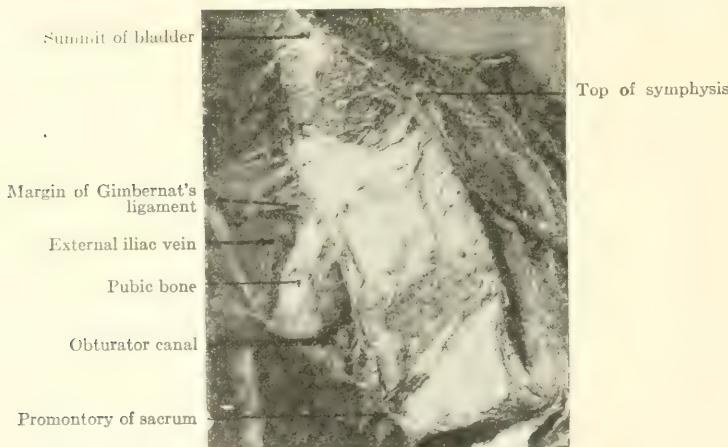


FIG. 6.—Left half of male pelvis looked at from right side and posteriorly. Rest of picture sacrificed to focus attention on femoral ring. Bladder in this specimen rises more than an inch above the top of the symphysis pubis. Normally it is at or below this level. It is also seen to extend close to the femoral ring and inguinal canal, the inner end of which is just above the femoral ring, so that the bladder might find its way into a femoral or a direct inguinal hernia.

no such vessels to interfere with the exposure and suture of the ring from the outside, where the suture can take hold of the substantial pecten muscle and overlying fascia forming the floor of the ring. This muscle arises as the bony margin of the ring, so that the suture catches it immediately below the ring. The advantage, therefore, should be with the external operation."



FIG. 7.—Right half of same pelvis shown in Fig. 6. Femoral ring filled and perhaps effectively plugged by a lymph node. Enlarged bladder again evident. Abdominal fold in abdominal wall above due to bending it forward.

This adds strong anatomical reasons to the clinical reasons I have already mentioned at length, against the inguinal method for femoral hernia.

RESULTS OF OPERATION FOR THE RADICAL CURE OF HERNIA AT THE HOSPITAL FOR RUPTURED AND CRIPPLED, NEW YORK. A summary of the operations performed at the Hospital for Ruptured and Crippled, from December, 1891, to January, 1916, is as follows:



FIG. 8.—Right half of pelvis showing femoral ring covered over by the obturator artery and vein which are coming from the deep epigastries. These might effectively prevent the development of a femoral hernia. On lifting these vessels and exposing the femoral ring, the margin of Gimbernat's ligament was found separated from the vein about a quarter of an inch. Much thickened bladder, probably due to its complete collapse.

Of a total of 5222 operations, 3795 were for oblique and direct inguinal hernia in the male, with 23 recurrences, = 0.66 of 1 per cent.; 959 operations were performed for inguinal hernia in the female, *i. e.*, 620 in children with one relapse, = 0.16 of 1 per cent.; 329 in adults with 12

relapses, = 3.6 per cent.; direct hernia, 10 with one recurrence, = 10 per cent.; 223 operations were for femoral hernia, 63 in children, without recurrence; 160 in adults with 6 recurrences, = 3.7 per cent.; 146 operations for umbilical hernia, *i. e.*, 49 in children, without recurrence, and 97 in adults with 3 recurrences, or 3.1 per cent.; 84 operations for ventral hernia, 19 in children, without recurrence; 65 in adults, with 10 recurrences, or 15.3 per cent.; there were 14 operations for epigastric hernia, all children, with one recurrence, = 7.1 per cent.; 1 operation for lumbar hernia in a child, without recurrence. In the total of 5222 operations, there have been 57 relapses, or 1.09 per cent.

*Methods of Operation.* 3796 operations for inguinal hernia were performed; in 3045 of these, the typical Bassini method with transplantation of the cord, was employed, with 14 recurrences = 0.45 of 1 per cent.; in 728, the cord was not transplanted, with 10 recurrences, or 1.37 per cent.

Of 146 operations for umbilical hernia, 31 were operated upon by the older method, with 2 relapses, or 6.4 per cent.; 115 by the Mayo overlapping method, with one relapse, or 0.87 per cent. Sixty-eight operations were performed for superficial and interstitial hernia, without relapse; 281 operations were done for hernia associated with an undescended testis, without recurrence. The technic used in these operations was the Bassini operation, without transplantation of the cord. In a few cases, Bevan's operation, with removal of the veins of the cord, with exception of the vessels of the vas, was used.

Thirty-seven operations were performed for strangulated hernia with two deaths.

**Undescended Testicle.** E. M. Corner, surgeon to the Children's Hospital and St. Thomas's Hospital, London, has for a long time been greatly interested in the imperfectly descended testicle. His first paper on the subject was published in the *British Medical Journal*, June 4, 1904. His later experience is published in the *American Journal of the Medical Sciences*, July, 1914, p. 51. He calls attention to the difficulty, and even impossibility, of deciding whether the condition of imperfect descent is temporary or permanent, and very properly observes that, so long as no hernia is present, there is no need of being in a hurry about answering the question. Neither need there be any hurry if the malformation is only unilateral. He believes that the expectant attitude should be terminated by:

1. The recognition of a hernia accompanying the imperfect descent, or
2. The recognition that the imperfect descent is not mere belatedness.

He holds that the presence of a hernia, in association with an imperfectly descended testicle, renders the indication for operation; "indeed" he states, "there is no other treatment for the hernia; a truss would press on the testicle or its vessels." He calls attention to one of the causes of the non-descent of the testicle, which is seldom

noted by writers on the subject, namely, "the non-separation of the tunica vaginalis and peritoneum which prevents the testicle from descending, even if it were capable of doing so. The hernial sac holds the gland up. Hence the cure of the accompanying hernial sac, by nature or art, will aid the testicular anomaly to be cured. In separating the sac from the cord, great care must be exercised to avoid injury to the vessels, for such an injury is known to militate greatly against the testicle subsequently having any physiological value." He believes when a patient has reached the age of seven years, there has been sufficient time to decide whether the condition is permanent or temporary. If permanent, he advises operative interference in either of the following ways:

1. The accompanying hernial sac may be divided and stripped of the cord, allowing the testicle to descend into the scrotum. Any but the mildest scrotal fixation is merely a prelude to failure, anatomical or physiological. Such an operation is called an orchidoplasty, or an orchidopexy.

2. The gland may be removed. This line of treatment is especially indicated when the imperfect descent is unilateral. It is satisfactory in its after-results. The operation is an orchidectomy.

3. Especially when the condition is bilateral, the gland may be returned to the abdomen, intraperitoneally. Any internal secretion which the gland may have is retained, and will aid the patient to develop sexual characteristics, such as hair on the face, male voice, male body, energy of mind and body. Such an operation is an *orchidocelioplasty*.

He believes that most forms of *orchidopexy* are liable to result in fibrosis and atrophy of the gland. In doubtful cases he considers *orchidocelioplasty* the best procedure, and states that the objection raised, that the returned testicles are prone to become malignant, is not well founded. He further states that it is not so, as has been urged, that in the intra-abdominal position, such common diseases as gonorrhreal orchitis endanger life. He believes that apparently the intra-abdominal position abolishes any external secretion, but preserves and encourages the internal secretion, an important point, he holds, as it is in the internal secretion above, that practically the whole value of the imperfectly descended testicle lies. He states that *orchidocelioplasty* is the operation more frequently done in these cases than any other. The percentage in his own work for the last ten years has been: *orchidopexy*, about 10 per cent.; *orchidocelioplasty*, about 50 per cent.; *orchidoplasty*, about 40 per cent.

Personally, I agree with Mr. Corner in his indications for operation, but not entirely in the type of operation to be recommended. I have never favored placing the testicle in the abdominal cavity, nor do I believe the only alternative to be *orchidectomy*, as pointed out by Corner. In most cases, by careful dissection, and removal of the

fibrous bands, it will be found possible to bring the testicle into the bottom of the scrotum without any fixation, and in such cases atrophy of the gland is not so likely to result. At the Hospital for Ruptured and Crippled, 281 operations have been performed from December, 1891, to January, 1916, for hernia associated with undescended testes, without recurrence. Mr. Corner lightly brushes aside the increased danger of malignant degeneration of the undescended testis. I formerly held the same opinion, but a more careful study of the reported cases, together with my own series of 66 cases of sarcoma of the testicle, in 12 of which the disease developed in the undescended testicle, has convinced me that I was in error.

In a paper recently published on Cancer of the Testis I stated:<sup>1</sup> "Howard found in 110,000 male patients admitted to various London hospitals during a period of twenty years, 65 cases of malignant disease of the testis, of which 9 occurred in the ectopic testicle, all of the inguinal variety, and none of the abdominal. Bulkley adds new data derived from a record of 12,729 consecutive male admissions to the Presbyterian Hospital of New York, giving 13 examples of malignant tumor of the testis, of which 11 were situated in the scrotum, and 2 in the abdomen. Combining these statistics we find that of 182,729 male admissions to general hospitals, there were 116 cases of sarcoma of the testicle, of which 12 occurred in the undescended testicle, only 3 of these occurring in the intra-abdominal testicle, or about one in each 60,000 cases.

"At the Hospital for Ruptured and Crippled, from 1890-1907, in 59,235 cases of inguinal hernia in the male sex there were found 737 cases of undescended testis, without a single case of sarcoma of the undescended testis. However, it should be noted that the statistics of the Hospital for Ruptured and Crippled, or of any large hernia clinic, do not give a fair estimate of the relative proportion of cases of sarcoma of the undescended testicle, inasmuch as many of these cases, particularly those of abdominal ectopia, will seek relief at some general hospital rather than go to a hospital devoted specially to the treatment of hernia. My own personal statistics throw, perhaps, some further light upon this question. During the past twenty-five years, I have personally observed 64 cases of sarcoma of the testicle. The first 25 of these cases occurred in the normally descended testicle; in the next two cases, however, the disease occurred in the undescended testicle. On going over my entire statistics I find that in 52 cases the disease occurred in the normally descended testicle and in 12 cases, in the undescended testicle.

"Different writers give different opinions as to the relative frequency of cancer of the normally descended and mal-descended testes. Shoedel encountered 5 cases of cancer of the inguinal testicle compared with

<sup>1</sup> Annals of Surgery, July, 1915.

36 cases of cancer of the normally placed organ; Odiorne and Simmons, in a review of 54 cases of malignant disease of the testicle observed at the Massachusetts General Hospital, found 6, or 11 per cent., in which the disease occurred in the undescended testes; of these, 4 were in the abdominal cavity, and 2 in the inguinal canal. Rademacher gives the proportion of malignant abdominal to malignant inguinal testicle, as 1 to 8. Meiser found 64 malignant inguinal as against 4 abdominal testes. Bulkley, himself, however, found at the Presbyterian Hospital 2 cases of malignant abdominal against 12 cases of malignant inguinal testes. An analysis of these cases encountered by Chevassu, Odiorne and Simmons, and the Presbyterian Hospital records, show the proportion as 1 to 5. My own statistics show almost the same proportion: 12 undescended in a total of 64 cases of sarcoma of the testis, or about 1- $\frac{1}{2}$ ."

**Rare Types of Hernia.** One of the rare cases of RETROPERITONEAL HERNIA cured by operation is reported by A. Rendle Short, of Bristol, published in the *British Journal of Surgery*, July, 1915, p. 48. Short's case was a woman, aged forty-eight years. She was admitted to the Bristol Royal Infirmary, on August 28, 1914, with symptoms of acute intestinal obstruction of five days' duration. Upon admission, the patient looked very ill, pulse 132, temperature 97°; abdomen distended and rigid. A diagnosis of intestinal obstruction was made, and immediate operation performed. About a pint of free fluid escaped, and coils of small intestine were seen to be dilated and congested. The examining hand detected fixation of the small bowel in the region of the right iliac fossa. In the region of the ileocecal junction, a pouch was found behind the cecum with the opening looking outward. This pouch contained about two feet of ileum. Above, there entered the distended afferent loop; below, was the collapsed efferent loop; between these was a projecting omega loop of black gut, apparently gangrenous. The condition formed a hernia en W. The anterior lip of the fossa was divided, permitting the incarcerated bowel to be released. After freeing of the constriction, the black portion of intestine recovered its circulation so much that it was believed to be viable. The wound was closed and the patient made an uneventful recovery.

Short believes this particular fossa one that has not been previously described; he does not believe that it comes in under any of the four types recorded, *viz.*, the retrocolic fossa, the ileo-appendicular fossa, the fossa of Hartmann, and the fossa iliaco-subfascialis of Biesiadecki. In the present case there was a pouch as large as a closed fist behind the cecum and ascending colon, approximately opposite the ileocecal valve but somewhat above its level; no tumor was palpable before operation. Short believes that the only other cases of pericecal hernia cured by operation are those reported by Marsh, Riese, Macewen, Aschoff, and Neumann.

He gives a resumé of the recorded cases of internal hernia from 1906, when the brilliant and comprehensive study of Moynihan and Dobson was published, comprising 65 cases of *left duodenal hernia*, with 8 recoveries after operation for strangulation. Short's own statistic, covering a period from 1906 to 1914, comprises 11 cases operated upon; in 9 there was acute strangulation; in 2 the diagnosis of ovarian cyst was suggested. Of 8 cases operated on with a known result, all but one were cured. He found 6 other cases which had produced no symptoms, and the condition was discovered only at autopsy or operation.

*Right Duodenojejunal Fossa.* Up to 1906, Moynihan and Dobson collected 17 cases, one of which was cured by operation. Short found only 1 case reported since; the patient died as a result of operation.

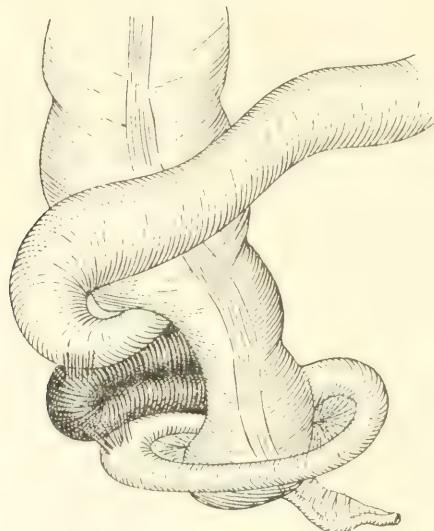


FIG. 9.—Retroperitoneal hernia. (Short.)

*Pericecal Fossa.* The retrocolic fossa lies behind the cecum and ascending colon; the opening looks downward. The opening in Short's case looked downward. Moynihan and Dobson found 7 cases of this type (pericecal), with 2 recoveries after operation for strangulation. Short was able to collect 3 other cases, 1 of which recovered.

*Hernia in the Ileo-Appendicular Fossa.* Moynihan and Dobson found 7 cases of hernia into this fossa, with 2 recoveries; no further cases were found by Short since 1906.

*Hernia of the Foramen of Winslow.* Moynihan and Dobson found 12 cases, to which Short has added 2.

*Hernia of the Intersigmoid Fossa.* Two cases had been reported at the time of Moynihan's paper, to which 1 has been added since—my own case, making 3 in all.

A unique case has been reported by Fromme, in which the bowel lodged in an abnormal fossa behind the symphysis pubis to the left of the median line and in front of the bladder, named "*Fromme's fossa.*"

*Hernia through the Transverse Mesocolon.* Four cases were recorded prior to 1906, to which have been added 3, since collected by Short (Halpenny, Stolzenberg and Mayo).

Allen<sup>1</sup> reports a case of ILEO-APPENDICULAR HERNIA OF THE APPENDIX, and reviews the literature of the subject. He believes that the theory of Moynihan, combining the ideas of Luschka and Brösicke, comes the nearest to a true explanation of the origin of these folds. He quotes Moynihan, as follows:

"If an embryo of the fourth month be examined, it will be found that, at the point of budding where the cecum is developing, an artery (the ileocolic) supplies two branches to the bud, one anterior, the other posterior. These two vessels lie on the surface of the gut immediately beneath the layers of the peritoneum. As the cecal bud increases in size, sprouting away from the mesenteric attachment, it would drag its vessels with it; but the cecal growth is more rapid than the vascular. The result is that the vessels seek a short path and run straight to their destination instead of following the outline of the gut. In doing so they pull up and drag upon the peritoneum in their neighborhood, and so lead to the formation of two distinct plica, the anterior and posterior vascular folds already referred to. At the end of the fifth month, when the cecal bud is easily recognizable, there is seen, in between the ileum and cecum, the intermediate fold already developed, and it contains between its layers the bundle of muscle fiber above mentioned. Now from the posterior or dorsal vessel, running in the posterior vascular fold, a branch is given off, which, running in a curved direction mounts upward eventually to the ileum. This is the ileo-appendicular artery, which lies in the free edge of the ileo-appendicular fold. The later development of this fold, then, it would seem, depends upon the vessel in its free margin. This theory, therefore, looks upon the ileo-appendicular fold as of a twin origin. It is a compound fold. Primarily it is muscular, dependent upon the ileo-appendicular muscle. Later, its development is modified by and attributable to the ileo-appendicular artery, the recurrent branch of the main appendicular vessel. This being the case, the ileo-appendicular fold is, in part at least, secondary to and dependent upon the posterior vascular fold, the meso-appendix. It is the last fold to appear in the embryo, less constant than the meso-appendix, and receives its vessel (upon which it to some extent depends for its existence) from the posterior vascular fold. It cannot, therefore, be the primitive mesentery of the cecum."

<sup>1</sup> Surgery, Gynecology and Obstetrics, August, 1913, p. 191.

*The ileo-appendicular fossa.* Having now a clear understanding of the origin and location of the fold, the fossa is found between it and the meso-appendix, its size depending mainly upon the size of the fold.

C. B. Lockwood was the first to study the condition of ileo-appendicular hernia of the appendix. His first observations were made in 1889 upon the cadaver, and the results of his investigations are embodied in his Hunterian lectures on hernia. He later published 2 cases found at autopsy.

As regards *causative factors*, Lockwood believes that these herniae may be either developmental or pathological. He cites 2 cases found in the course of surgical operations, and also mentions a case of acute strangulation of the appendix in the ileo-cecal (ileo-appendicular) fossa, described by Heaton.

Allen's own case occurred in a Japanese laborer, aged thirty-six years, who entered St. Luke's Hospital of San Francisco, in October, 1911. The trouble had begun twenty days previously, with symptoms of a mild attack of appendicitis. Upon operation, an abscess the size of an English walnut was found. It was decided to remove the appendix, for which purpose ligatures were passed at the upper border of the mass. On tying and cutting these, it was found that no proper mesentery of the appendix had been divided. In order to free the mass, ligatures were then passed below, and what was supposed to be the lumen of the appendix was tied off and divided. This not freeing it, another was passed closer to the bowel, which proved to surround the real appendix. On again examining the lower ligature, it was found that the ureter had been divided; the other end of the latter was discovered in the connective tissue, showing that the right ureter had become enclosed in the mass of inflammatory tissue with the appendix. The mass was removed entire. It was further seen that the ileum was below the previous site of the abscess passing to the right over the top of the cecum, which was drawn up under it to the left and the two united by fresh adhesions. On separating the latter and straightening out the ileum, it became necessary to pass the stump of the appendix through the mesentery of the ileum before it could be inverted into the cecum. The hole in the mesentery of the ileum was then sutured and the two ends of the ureter united.

In reviewing this case, Allen states that the appendix was situated above the ileum and to the inner side of the ascending colon; the stump of the appendix had to be passed beneath the ileum through its mesentery in order to render possible inversion into the cecum; that the whole mass was retroperitoneal, including  $\frac{1}{2}$ - $\frac{3}{4}$  inch of ureter as shown on examination of the abscess mass. He believes the only explanation of these conditions would be a hernia of the appendix into the ileo-appendicular fossa, its subsequent inflammation with abscess formation and the involvement of the ureter within the inflammatory mass.

Voeckler<sup>1</sup> reports a case of SUPRAPUBIC HERNIA OF THE LINEA ALBA, observed at the Magdeburg Hospital, a form of hernia, which, he states, has so far not been described in the literature.

The patient, a woman, aged forty-four years, had had a hernia the size of a pigeon's egg immediately above the symphysis, for the last two years. It had given her no trouble until sixteen hours before her admission to the clinic, on June 16, 1911, when she suddenly developed pronounced symptoms of incarceration, with marked increase in the size of the hernial tumor. The latter, at the time of admission, was situated in the pubic region, extending into the labium majus as well

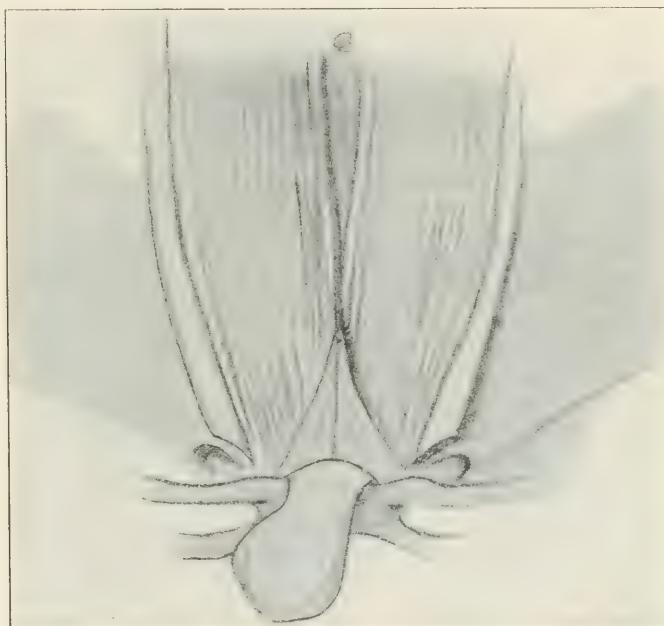


FIG. 10.—Outward view of anterior abdominal wall; anterior sheath of rectus removed, its borders turned outward. Hernial opening and sac.

as slightly beyond the median line on the left, and considerably so on the right side. Deep palpation was painless everywhere except in the region above the symphysis. Vaginal and rectal examination were negative. A definite diagnosis was not made before operation, but a hernia with an unusual opening—probably somewhere along the lower border of the symphysis—was thought of, nor could the possibility of a cyst of the round ligament, with volvulus, be definitely excluded. Operation showed a tense, bluish tumor, the size of a pear, extending into the labium. Firm adhesions rendered isolation of the sac difficult.

<sup>1</sup> Deutsch. Ztschr. f. Chir., July, 1912.

The contents consisted of a loop of greatly discolored small intestine 6 cm. in length, tightly wedged in the hernial opening, and a large amount of brownish fluid. The gangrenous gut was resected, end-to-end anastomosis, with suture and ligation of the sac was performed, with exact suture of the peritoneum, and suture of the transverse fascia grasping the pyramidal muscles above the symphysis. This was followed by continued suture of the right and left anterior sheath of rectus, and drainage of the bed of the sac for two weeks. The patient was discharged cured on July 15.

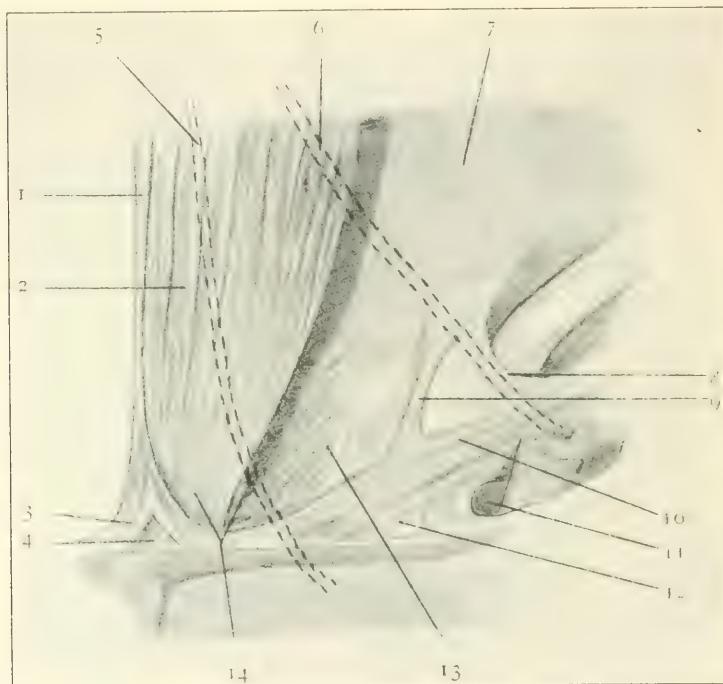


FIG. 11.—Inner view of anterior abdominal wall after removal of peritoneum: 1, linea alba; 2, rectus muscle; 3, adminiculum lineaæ albæ; 4, fossa adminiculi; 5, direction of the plica umbilic. lat.; 6, direction of the plica epigastrica; 7, transverse abdominal muscle; 8, lig. interfoveolare; 9, M. interfoveolaris; 10, Poupart's ligament; 11, femoral opening; 12, Gimbernat's ligament; 13, place of passage for direct hernia; 14, supravesical fovea.

Of paramount interest in this case, Voeckler states, are the location of the hernial tumor, and the anatomical conditions of its opening. The accompanying illustrations give a very good idea of the conditions found.

Voeckler believes that in all probability the hernia described by him actually passed into what he calls the fossa adminiculi linea alba, and thus found its way outward. The only other possibility, which he,

however, does not think at all likely, would be that the hernia found its way between the median border of the rectus and the linea alba, and, after pushing apart the pyramidal muscles, came out above the symphysis.

Voeckler briefly refers to the various anterior and retroperitoneal supravesical herniæ reported in the literature, and points out the great differences existing between these and his own case. He considers the term "supravesical hernia" as entirely too general to include in it the case described by him. The latter's purely median location above the symphysis and its apparent relation to the linea alba, are sufficiently characteristic, he believes, to exclude it from the class of supravesical hernia despite its origin in one of the vesical foveæ. It is divided from the external supravesical hernia by the entire widths of the rectus sheath and stands practically in the same relation to them as to the external inguinal hernia to crural hernia. He believes the term "hernia lineaæ albæ suprapubica" best describes the existing anatomical conditions. Voeckler believes his case unique, and gives a brief report of 5 cases of other men, which show some similarity with his own, at least as regards the region in which the hernia came out.

Gontermann,<sup>1</sup> reports a case of SUPRAVESICAL CRURAL HERNIA, in which the lateral umbilical ligament formed part of the sac.

The patient was a woman, aged thirty-six years, who claimed to have noticed a reducible hernia on the right side for the last three months. Operation, April 27, 1912: On freeing of sac, difficulty was experienced in pulling it forward. After removing the overlying fat, a yellowish-white band, about 3 mm. in width, was found running across the sac, forming a shallow furrow; the two ends of the band ran along the neck of the sac into the crural canal; one, medially upward, the other, laterally downward. The band which gave the impression of being a ureter, could be bluntly freed from the sac, and the latter then be pulled forward twice as far as before. Introduction of the finger into crural canal showed one end running into the depth of the peritoneum laterally to the bladder, the other end leading in the direction of the umbilicus anteriorly to the peritoneum. It was seen, on pulling at this umbilical end, that the umbilicus was drawn inward, showing that the band was adherent to the umbilicus. It was clear, therefore, that it was not the ureter, but the lateral vesical umbilical ligament, which had passed with the hernial sac through the crural canal. Resection of several inches of this band, the ends being buried in the depth. High resection of the sac; closure of the canal by suturing Poupart's ligament to the periosteum of the pubic bone. Cystoscopy done after healing, showed a pointed distention of the bladder toward one side.

<sup>1</sup> Arch. f. klin. Chir., 1914, Bd. 104, Heft 1.

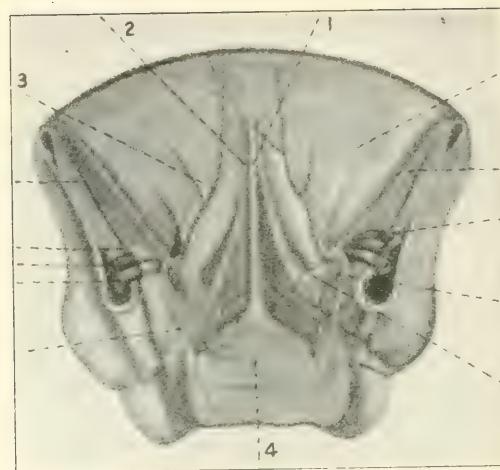


FIG. 12

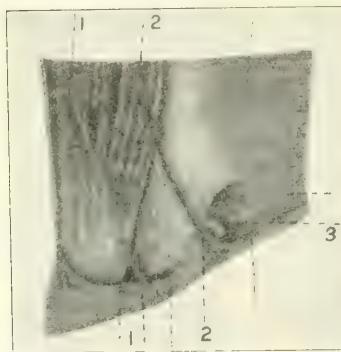


FIG. 13

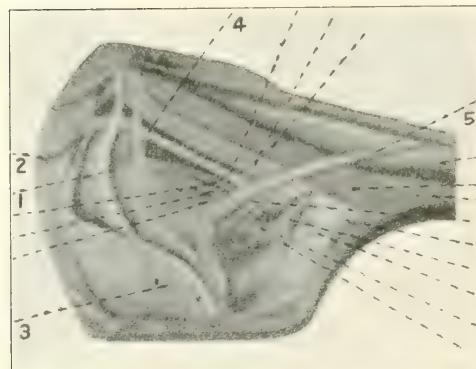


FIG. 14

This case, Gontermann states, is interesting from three points of view:

1. The location of the internal ring (medially to the lateral umbilical ligament same as in supravesical hernia).

2. The passage of this supravesical hernia through the crural canal.

3. The fact that the lateral umbilical ligament formed part of the sac.

Gontermann states that he found but one analogous case in the literature, namely, that of Laugier, described by Schmidt, *i. e.*, an incarcerated crural hernia. Autopsy in this case showed that the hernial opening was not in the crural ring but further inward, in the middle of Gimbernat's ligament, or divided from the crural canal by the fibrous strip, and the obliterated vesical band of the umbilical artery.

An unusual case of STRANGULATED FEMORAL HERNIA, treated by resection of the gut, in a patient, aged eighty-three years, is reported by Walter W. Mott,<sup>1</sup> of White Plains, N. Y.

The cases of successful resection of the bowel in patients more than eighty years of age, are extremely few in number. In this case the strangulation had existed for thirty-two hours. The operation was performed under local anesthesia. A piece of ileum, 6 inches long, was resected, and end-to-end anastomosis made with sutures. The united intestine was replaced with some little difficulty through the femoral ring. The patient made an uninterrupted recovery. She was taken out of bed as soon as possible after operation, to avoid pulmonary hypostasis.

I believe the success in this case was largely due to the use of local anesthesia.

**Internal Hernia.** Fisher<sup>2</sup> reports a case of incomplete rotation of the intestinal loop as a cause of RETROCOLIC HERNIA. He mentions Moynihan's analysis of hitherto reported cases of retrocolic hernia, 14 in number, only 7 of which the latter adjudges as genuine.

With regard to the anatomy of the retrocolic pouch of peritoneum, Fisher states that the retrocolic fossæ vary considerably. Often they are both absent, and, in the majority of cases, only one is present. He cites Berry's statistics, which showed that the internal fossa alone was found in 15 per cent.; both fossæ in 10 per cent., and the external fossa alone in 5 per cent.

As to the development of the retrocolic fossæ, he states that although Treitz, Gruber and Lockwood believe them to be of primary origin, he is inclined to agree with Toldt who holds that the retrocolic fossæ are of secondary origin, being due to delayed adhesion of the ascending colon, cecum and ileocecal angle to the posterior abdominal wall.

The principal symptoms of retrocolic hernia are those of strangulation

<sup>1</sup> Journal of American Medical Association, January 17, 1914.

<sup>2</sup> Lancet, July 18, 1914.

of the bowel; severe pain in the abdomen followed by vomiting and obstipation.

Fisher's case of retrocolic hernia was found at autopsy, the patient, a man, aged seventy-five years, having died of senile degeneration of the heart. Upon opening the abdomen, a broad, apron-like fold was seen stretching across the greater part of the right side of the abdomen (Fig. 15). Further examination proved this to be the anterior wall of the hernial sac, attached to the hepatic flexure of the colon, ascending colon and cecum on the left, to the lower border of the

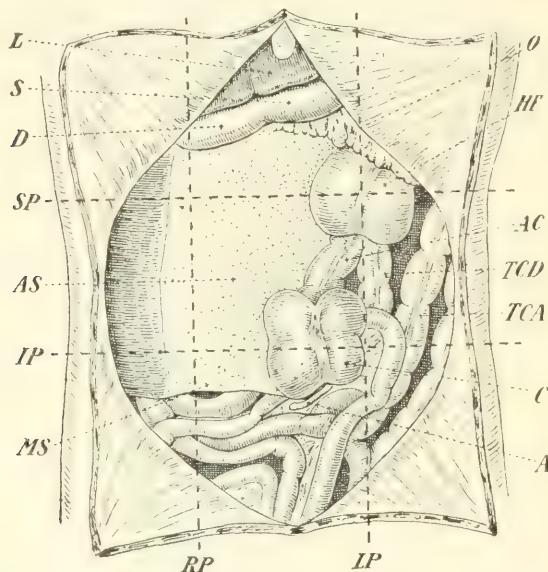


FIG. 15.—Sketch of appearance on opening abdomen: *D*, duodenum (first part); *L*, liver; *S*, stomach; *O*, great omentum; *SP*, subcostal plane; *AS*, anterior wall of sac; *IP*, intertubercular plane; *MS*, mouth of sac; *A*, appendix; *RP*, right latero-vertical plane; *LP*, left laterovertical plane; *HF*, hepatic flexure of colon; *AC*, ascending colon; *TCD*, transverse colon, descending limb; *TCA*, transverse colon, ascending limb; *C*, cecum.

duodenum above, being adherent to the right edge of the large omentum; on the right side it bulged somewhat and became continuous with the peritoneum over the right kidney and iliac fossa; below, it presented a free edge, not tense and devoid of any vessel. The lower free edge ran in the interspinous plane and was attached laterally to the peritoneum over the right psoas muscle, and internally to the posterior surface of the appendix and meso-appendix.

Fisher believes that in his case, "the rotation of the U-shaped loop ceased at the point where the distal limb lay in front of the proximal limb. Secondary adhesion of the distal limb to the peritoneum of the posterior abdominal wall occurred early and imprisoned the proximal

limb of the loop from which the greater part of the small intestine is formed. Thus the cecum was prevented from swinging upward and to the right to its position beneath the liver. The small intestine developed toward the right chiefly, and in its growth pushed the large intestine to the left side of the abdomen. The peritoneum, connecting the right part of the posterior surface of the ascending colon to the posterior abdominal wall, became greatly stretched and formed the anterior wall of the sac. The abnormal position in which the small intestine developed accounts for its extreme shortness and also explains why the descending and iliac colon have both a mesentery. The form of the duodenum, the presence of its mesentery, the absence of the duodenojejunal flexure and the position of the superior mesenteric artery all show that rotation stopped at the above mentioned stage.

In view of the above findings, Fisher concludes that this form of hernia is due to an abnormality of development occurring at a very early stage:

In connection with this case may be cited the case of RETROPERITONEAL HERNIA of the appendix into the ileo-appendicular fossa, by Seff,<sup>1</sup> of Beth Israel Hospital.

Seff's case, a male, aged thirty-two years, was admitted to the hospital August 17, 1913. The trouble had begun three days prior to admission, with severe abdominal pain, nausea, vomiting, fever and constipation; he had had two similar attacks during the preceding year. Temperature was 101.8° on admission. The case was regarded as appendicitis, and operation was not performed until three days later. Anoxic-association anesthesia was given. Peritoneum was opened and found normal; cecum freely movable. Appendix could not be felt; incision was enlarged; cecum was pushed up toward liver and ileum drawn over to the left. Just below the ileocecal junction, on the smooth peritoneum there was seen an area of fibrinous exudate the size of a quarter. This was easily removed, revealing an opening into a small fossa, having a free margin concave to the left; the appendix was seen to pass over the edge. Beneath this fold which was undoubtedly the ileo-appendicular, the handle of the scalpel was passed into the fossa for a distance of  $\frac{3}{4}$  inch. Beneath this fold a small tender mass was felt, which could not be disengaged. In order to remove the appendix, it was necessary to incise the fold from the middle of its concave border for  $\frac{3}{4}$  inch. The appendix was congested, the tip bent upon itself. The cut edge of the fold was sutured together with the serous covering of the appendix, thereby obliterating the fossa. The patient made an uneventful recovery.

*Pathological Report: Acute Suppurative Appendicitis.* It does not seem fair to class this case as a typical or genuine case of hernia in the

<sup>1</sup> Medical Record, May 23, 1914.

ileo-appendicular fossa. The acute inflammatory conditions may have obscured the anatomical relations.

The ileo-appendicular fold, is described by Moynihan as follows: "The fold extends from the lower border of the ileum, that directly opposite the line of the mesenteric attachment—to the anterior surface of the meso-appendix. It is quadrilateral in outline. The upper border is attached to the ileum for an extent which is extremely variable. An average length will be between  $1\frac{1}{2}$  to  $2\frac{1}{2}$  inches. The lower border extends from an angle formed by the appendix with the cecum, inward on the anterior surface of the meso-appendix, along a line parallel to the upper border, when the appendix is straightened out. Sometimes this line of attachment is shifted to the appendix itself. Its outer or right border is attached to the inner aspect of the cecum as far down as the root of the appendix. Its left or inner border is concave to the left and free. This edge contains the recurrent or ileo-appendicular artery, given off from the main appendicular, just above the level of the ileum.

OBTURATOR HERNIA. McMahon<sup>1</sup> reports a very interesting case of an exceedingly rare type of obturator hernia: The patient, male, aged sixty-five years, states that he has had a hernia for four years, that it had been reducible until June, 1915. At this time it became irreducible, causing pain and shock, followed by complete constipation and profuse vomiting. He refused operation until June 27, when examination showed a temperature of 99°, pulse 104; abdomen not markedly distended; large right-sided hydrocele; inguinal and femoral canals apparently normal; no fulness in the obturator region; Romberg's sign present and a peculiar tense mass could be made out on rectal palpation. In describing his old hernia, he referred its location to the obturator region. He stated that he had been benefited by a truss fitted by himself. Operation under ether, consisted, first, in exploration of the inguinal and femoral regions by a Bassini incision. Finding nothing abnormal, a median abdominal section was immediately made. The small intestine was found distended, the cecum collapsed. Examination showed an incarcerated hernia in the obturator foramen; an incision over the obturator region was then made and the sac freed; the pectenous muscle was exposed by the usual vertical incision inside the femoral artery and its fibers separated, a rather small hernial sac was found tightly bound down by adhesions. There was no evidence of circulatory impairment of the intestine and only a few abrasions of the surface near the mesenteric border. The obturator opening barely admitted the tip of the index finger, the sac was ligated and the obturator incision closed. The patient made a good recovery and left the hospital July 15.

<sup>1</sup> Annals of Surgery, December, 1915, p. 710.

McMahon believes, in view of the difficulty of a positive diagnosis in these obscure cases, that median abdominal laparotomy has many advantages. Among these are, that "the diagnosis is immediately made clear, the obturator foramen can be easily inspected; if the intestine has been injured, repair is much more easily accomplished through an abdominal incision. The obturator foramen can be closed from within or without." He further believes that prompt laparotomy in the early stages in all cases of intestinal obstruction will greatly lower the mortality in cases of obturator hernia.

This type of hernia is extremely rare; Mumford was able to collect only 200 cases from the literature.

Meyer, of the Leipzig Clinic, states that only 51 had been reported since 1875.

Graser's statistics covering a period from 1720 to 1890 shows 118 cases.

Apparently this type of hernia is observed much more frequently in women than in men. 79 per cent., according to Meyer, occurred in women over sixty years of age, and the statistics of other authors agree with this.

Among the supposed causes of obturator hernia are, frequent pregnancies producing laxity in the peritoneum, emaciation, which removes the normal cushion of fat in this region; subserous lipomas, which are often found in conjunction with this type of hernia.

The diagnosis is extremely difficult. As far as known, there are no recorded cases of operation for non-strangulated obturator hernia; an external swelling sufficient to form a tumor is very rarely present; localized pain is a more prominent symptom. This pain is usually situated in the inner portion of Scarpa's triangle near the pubic spine, occasionally it radiates down to the inner side of the limb; pain of this character is known as Romberg's sign and is due to compression of the obturator nerve. Vaginal examination in women, and rectal in men, may discover a characteristic swelling. The constriction which causes strangulation is supposed to be due to the edge of the obturator membrane external to the sac.

The mortality of obturator hernia remains high. Grasser's statistics showed 78.81 per cent., in 118 cases. Meyer's mortality rate was 54.27 per cent. in 6 cases; Levit had a mortality of 50 per cent. in 4 cases.

Personally, we have never observed a case of obturator hernia at the Hospital for Ruptured and Crippled in a series of upward of 100,000 cases in the out-patient department, of which 5 cases were operated upon.

**Intra-abdominal Hernia.** Pikin<sup>1</sup> differentiates the following five forms of intra-abdominal hernia:

<sup>1</sup> Arch. f. klin. Chir., 1912, Bd. 98, Heft 2.

1. Hernia of the foramen of Winslow.
2. Intersigmoid hernia.
3. Pericocecal hernia.
4. Duodenojejunal hernia.
5. Parajejunal hernia (hernia mesentericoparietal).

Without referring to the complicated question of the origin of these five forms of fossæ, Pikin gives a brief description of their anatomy. He also reports a personal case of duodenojejunal hernia in a woman, aged twenty-seven years, in which the hernia containing the entire small intestine with exception of 30 cm. of the lower ileum, was situated between the mesenterial folds of the same small intestine, the hernia having entered the mesentery in the region of the duodenojejunal fossa. He states there was no real incarceration in this case, and he believes

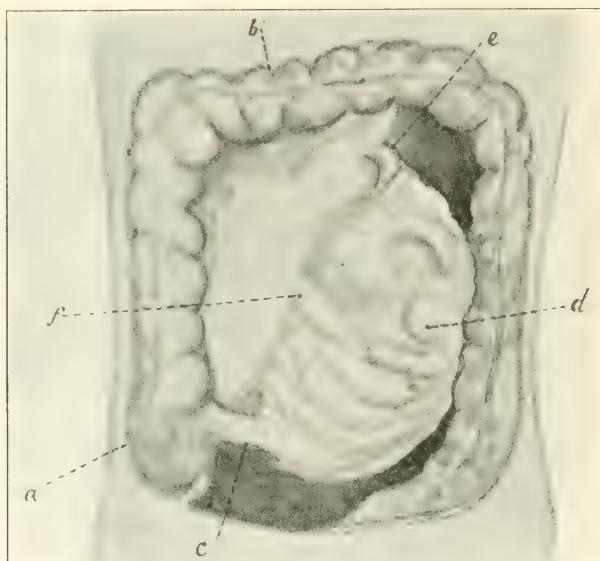


FIG. 16.—Conditions found in Pikin's case.

that the paresis of the gut present, as well as the clinically pronounced occlusion of the gut, must be explained on basis of the spasm of the gut at a place in the ileum where ascarides were found. In other words, he believes they had to deal with a case of *ileus verminosus* due to the weakened peristalsis, resulting from the hernia. The patient made a good recovery and was discharged as cured at the end of four weeks.

Pikin states that of 91 published cases of duodenojejunal and parajejunal hernia, only 17 were subjected to operation. In all the other cases, the hernia was accidentally discovered at autopsy.

This form of hernia has been observed more frequently in men than in women, and usually in subjects beyond the twentieth year of age.

Pikin does not believe that the diagnosis of this form of hernia is possible in the early stages of its development; a correct diagnosis was made thirteen times in the 17 cases operated upon.

**Tuberculosis of the Hernial Sac with Special Reference to the Pathological and Clinical Course** is discussed by John T. Morrison,<sup>1</sup> of Liverpool. He refers to the extended review of the subject published by Gaston Cotte,<sup>2</sup> in 1906. In this series of cases 257 were found in children under the age of five years. According to the statistics of the Royal Hospital for Sick Children, Edinburgh, it occurred in about 2 per cent. of the cases.

This would seem to me an abnormally large percentage. In a series of 4571 cases of hernia in children operated upon at the Hospital for Ruptured and Crippled from 1891 to 1916, there were 23 cases of tuberculous hernia of the sac. In an institution like the Hospital for Ruptured and Crippled, it would seem that at least a normal percentage of cases with tuberculosis of the hernial sac should be found, inasmuch as not infrequently cases admitted for tuberculosis of bones or joints, having hernia are operated upon. Such cases would be more likely to have tuberculosis of the hernial sac than the ordinary cases admitted to a general hospital for operation.

Morrison states that during adult life the number of cases sinks to a minimum, but, after the age of fifty, there is an appreciable increase in frequency.

As regards the PATHOLOGY of the disease, he differs from Jonnesco who maintains that the hernial sac is the part of the peritoneum first affected. Morrison's theory is based on the assumption that, granted a tubercular focus within the abdomen, an inguinal hernial sac would be the first place to be infected on account of the gravity of the fluids carrying the bacillus. Morrison states that while it is impossible to bring forward conclusive proof, certain facts bear strongly against Jonnesco's view, the first being that there are no reported cases in which postmortem examination had been made, which did not show the presence of abdominal tuberculosis when the hernial sac was tubercular. Again, on numerous occasions, when the clinical evidence of peritoneal tuberculosis was believed to be absent, autopsy or operation revealed its presence.

The PATHOLOGICAL CHANGES seen in a tuberculous sac may be "small gray tubercles, few in number and scattered, most likely in the neighborhood of the fundus of the sac, more rarely about the neck; in another group of cases the tubercles are very numerous and closely packed together, producing a somewhat velvety surface, pinkish-gray in color. In other cases still, the tuberculous granulations may com-

<sup>1</sup> Liverpool Medico-Chirurgical Journal, 1914, xxxiv, 301.

<sup>2</sup> Rev. de Gyn., 1906.

pletely fill the sac, obliterating its lumen. In other cases, nodules or plaques develop on the peritoneal lining, varying in size from a mustard seed to a hazelnut. In rare instances the nodules may break down, forming localized collections of tuberculous pus."

Personally, I have never seen this type.

Hydrocele is not an uncommon complication, but associated with tuberculosis of the testis, it is very rare.

In regard to the clinical course, in the cases observed at the Edinburgh Children's Hospital, 75 per cent. of the mothers gave the ordinary history of rupture; some patients seemed in perfect health, and, in the absence of any symptoms, the abdominal tuberculosis would not have been detected, had it not been for the hernia operation. In cases in which the hernial sac was recognized as tubercular, thereby making it probable that abdominal tuberculosis existed, it was not possible to determine this clinically in more than 36 per cent. of the cases.

As regards the diagnosis, it is rarely possible to make this prior to operation. The cord and sac will show marked thickening, and in some cases it is possible to feel small tubercular nodules in the sac.

With reference to the prognosis, Morrison states that a study of the after-history of children who suffered from tubercular hernia brought out some startling facts. No fewer than 11 per cent. out of 27 cases traced, were found dead of general tuberculosis; 3 more were seriously ill when last heard from, 2 with tubercular enteritis, 1 with meningitis. It is doubtful if any of the 3 recovered, thus making the total mortality above 11 per cent.

Morrison states that the benefit derived from the operation is very doubtful. He gives a brief abstract of 6 cases personally observed.

One was in perfect health twelve years afterward; the second case was not traced; the third was well five months; the fourth was in good health six years later, though looking delicate; the fifth died four years later from tubercular meningitis the sixth remained in good health one and a half years later.

# SURGERY OF THE ABDOMEN, EXCLUSIVE OF HERNIA.

BY JOHN C. A. GERSTER, M.D.

**Paravertebral Anesthesia** has been mentioned in previous reviews.<sup>1</sup> The technic employed by Adam, of Dollinger's clinic in Budapest, differs in certain details from the methods already cited. Adam<sup>2</sup> employs 1 per cent. novocain in a 4 per cent. potassium sulphate solution. (The potassium sulphate is supposed to cause accentuation and longer duration of the anesthetic effect.) The patient sits while injections are being made. In order to render the entire abdominal cavity, including the pelvis, insensible, all of the nerves on both sides, from the fifth thoracic to the third lumbar, must be blocked. The technic is as follows:

At the upper margin of the fifth rib, about 4 cm. from the spines of the vertebrae, the skin is rendered anesthetic by infiltration. Through this anesthetic area one introduces the needle until it reaches the junction of the transverse process with the rib, that is, about 4 cm. from the median line. The lower margin of the rib is now sought with the point of the needle, and 2 c.c. of novocain are injected to block the intercostal nerve. After this, the point of the needle is introduced 1 cm. deeper, in a mesial direction, and 3 c.c. more are injected in order to block the rami communicantes. Next, the needle is withdrawn until its point remains in the subcutaneous tissues. The point is now turned and the needle is directed downward beneath the skin, parallel to the spinal column until it reaches the next intercostal space; and so the skin over the next point of injection is rendered anesthetic. The greatest amount of novocain used in this process is between 120 and 160 c.c. of a 1 per cent. solution. In a large series of cases, untoward effects from the use of novocain were experienced in only three. In operations upon the kidneys and gall-bladder, naturally only unilateral injection is necessary. In appendicitis operations (95 cases) the operative area was blocked by novocain infiltration of the abdominal wall down to the peritoneum in a rhomboid form surrounding the area of incision. To prevent pain caused by delivery of the appendix and by traction upon its mesentery, the subserous injection, according to Fowelin,<sup>3</sup> was used, *i. e.*, retroperitoneal deposits

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1913, p. 69; 1915, pp. 59, 61.

<sup>2</sup> Deutsch. Ztschr. f. Chir., 133, p. 1.

<sup>3</sup> PROGRESSIVE MEDICINE, June, 1914, pp. 137-138.

of 10 to 20 c.c. of 1 per cent. novocain, inserting the needle just mesial to the anterior superior spine. In a few cases it was necessary to employ general anesthesia.

**Transverse Abdominal Incisions** have been discussed in previous issues of PROGRESSIVE MEDICINE.<sup>1</sup> Willy Meyer<sup>2</sup> reports that he used the transverse incision in 8 cases, and is well pleased with it. Moschcowitz<sup>3</sup> has had a personal experience in over 100 cases. About half of these were for operations upon the bile passages necessitating drainage. The rest were for operations upon the stomach and duodenum. He has kept track of his cases and so far has seen no hernia of the wounds. Rockey<sup>4</sup> advocates transverse incision for exposure of the appendix,

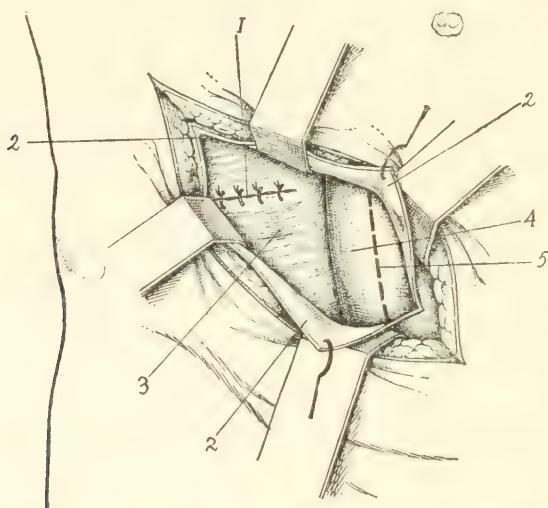


FIG. 17.—Harrigan's modified McBurney incision: 1, internal oblique and transversalis muscles sutured; 2, external oblique aponeurosis incised to its insertion in sheath of rectus; 3, internal oblique muscle; 4, sheath of rectus; 5, incision in sheath of rectus.

admitting, however, that a definite preoperative diagnosis is important and that when the diagnosis and exact location of appendix is uncertain, the vertical incision is preferable.

The modified McBurney incision for the treatment of appendicitis and pelvic disease, as devised by Harrigan<sup>5</sup> is well illustrated in the two accompanying diagrams (Figs. 17 and 18). The indications for its use will be exceptional, because the appendix can, as a rule, be removed with ease through even a median incision. In the course of operations

<sup>1</sup> June, 1908; 1912, p. 51; 1913, p. 70; 1914, p. 73; 1915, p. 61.

<sup>2</sup> Annals of Surgery, November, 1915, p. 573.

<sup>3</sup> Personal communication.

<sup>4</sup> Journal of American Medical Association, lxxv, 939.

<sup>5</sup> Surgery, Gynecology and Obstetrics, December, 1915, p. 782.

upon the adnexæ, the Kammerer, or transrectus, incisions possess the advantage of rendering the adnexæ, as well as the appendix, accessible to the operator in a simpler fashion than the Harrigan method.

**Gunshot Wounds of the Abdomen in War.** For the benefit of those with limited time for reading, a brief summary will precede a somewhat more detailed review of the great quantity of material which has come to hand.

**SUMMARY.** No new methods of treatment have been evolved. The entire question has revolved around indications for operative interference. At first, when the armies were still actively moving, it took nearly a week before the wounded reached hospitals equipped with adequate surgical facilities. At this time the advocates of the conser-

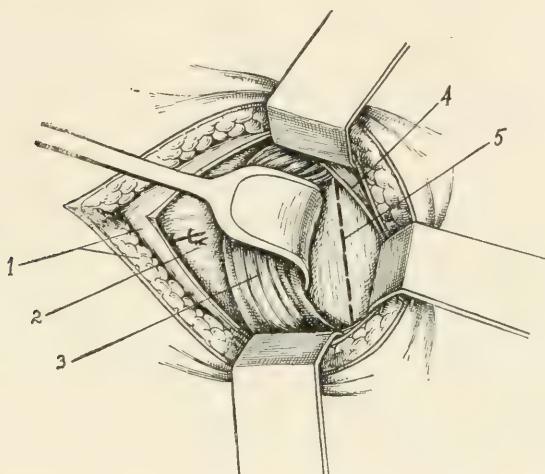


FIG. 18.—Harrigan's modified McBurney incision: 1, skin, fat, and external oblique muscle; 2, internal oblique muscle; 3, rectus retracted outward; 4, cut edge of rectus sheath retracted; 5, incision through peritoneum.

vative (non-operative) treatment held the upper hand—the mortality from operations was distinctly higher than from non-operative measures (*i. e.*, morphine, Fowler's position, starvation, administration of water subcutaneously or by proctoclysis).

Later, when the great forces settled down to practically fixed positions in trenches, transportation improved and the wounded reached the surgeons in a much shorter time: now the advocates of immediate operation came into their own.

The consensus of opinion at present indicates that every penetrating wound of the abdomen should be operated on within the first twelve hours, provided the patient's condition permits. Shock is no contraindication. In short, the indications are identical with those which hold for gunshot wounds of the abdomen encountered in civil life.

The knowledge gained from autopsy and operative experience in the present war indicates that those not dying from hemorrhage upon the field of battle, die from peritonitis upon the second, third, or fourth day (Toepfer).<sup>1</sup> The patients with abdominal wounds who reach a base hospital alive at the end of a week, represent an extremely small fraction of the total number who have sustained abdominal wounds upon the battlefield. Among this relatively small group of cases are:

1. Those diagnosed as penetrating injuries of the abdomen, but actually without penetration of the hollow intra-abdominal viscera (*i. e.*, there has been a tangential injury of the abdominal wall, or else a very rare, but repeatedly observed happening) the projectile has traversed the abdomen without injuring stomach or intestines.

2. Wounds of the stomach (much more given to spontaneous healing than those lower in the alimentary canal).

3. Those in which the inflammatory process had become localized.

Naturally, under such circumstances, the conservative treatment gave relatively good results, and so the erroneous impression was gained, that wounds of the abdomen sustained in war gave a lower mortality than in civil life. To be of value, statistics regarding abdominal wounds must include: The percentage of those dying upon the battlefield, the percentage of wounded dying near the front, and the percentage of those dying long after injury, *i. e.*, those invalidated home. The rule is not to report cases "cured" unless they are seen on the fifteenth day after operation and are doing perfectly well at that time (Rochard, see below). Individual surgeons have given their personal experiences, but they were not in a position to obtain the above-mentioned data, hence they were led to draw erroneous conclusions. (It is to be noted that most medical observers in previous wars of recent date were stationed at base hospitals far from the front.)

To take up the subject in greater detail, we shall see how opinions changed as transportation of the wounded improved.

FRENCH. Tuffier,<sup>2</sup> speaking from his early experience, says, "As regards laparotomy for a wound of the small intestine with suture, resulting in cure, I do not believe that there exists at the present time 20 such cases in the French Army. These failures depend on the multiplicity and gravity of the wounds, the condition of the patient, and the precarious state of the resources for operation at the front. For this reason automobiles have been attached to the surgical ambulances. Later on we shall be in a position to appreciate their utility."

Wounds of the peritoneum, or of the large intestine, gave numerous favorable results. Tuffier<sup>3</sup> conceded that immediate laparotomy is the

<sup>1</sup> Deutsch. med. Wehnschr., 1915, No. 6.

<sup>2</sup> British Journal of Surgery, July, 1915, p. 111.

<sup>3</sup> Surgery, Gynecology and Obstetrics, September, 1915, p. 283.

best procedure where this can be carried out, and that expectant treatment is a last resort, but has given good results in many cases.

Delorme<sup>1</sup> stated that immediate laparotomy was not to be used.

Crile,<sup>2</sup> who served several months at the American Ambulance in Paris, said: "Penetrating wounds of the abdomen have baffled surgeons. Even in the most skilful hands, immediate operation usually ends fatally, death being due to gunshot infection. Occasional cases recover, with or without operation. I expect later to hear a more favorable report regarding these cases from the Belgian Field Hospital which is situated near the front."

(The Belgian Field Hospital is at La Panne, within a few miles of the trenches, so that the wounded are brought within an hour or two to the operating room where De Page, who is chief surgeon, is constantly in attendance.)

As time went on, the tide of opinion began to turn.

Leriche<sup>3</sup> gave the mortality of expectant treatment as between 70 and 85 per cent. He urged that a systematic attempt at operative treatment be made, and believed that the high mortality then present could be reduced in this way.

Carrel said, "The general state of the wounded is dependent upon the quickness with which they can be transported to a hospital where adequate attention is provided."

The Paris correspondent of the *Journal of the American Medical Association*,<sup>4</sup> in his letter of July 1, 1915, voiced the opinion that: "A good surgeon may, if he operates soon after the wound is received and under good conditions, insure recovery in cases of abdominal wounds which otherwise would be fatal. The question of early opportunity depends therefore upon the rapidity and suitability of transportation."

Delore,<sup>5</sup> in a series of over 1500 cases, did not know of a single penetrating wound of the abdomen which recovered without laparotomy. The cases incorrectly diagnosed as having a penetrating wound of the abdomen which subsequently recovered, and which actually had no injury of the alimentary tract, furnish the misleading statistics for advocates of conservative treatment.

Quenu<sup>6</sup> collected a series of observations by other surgeons and summarized them as follows: Operative treatment is preferable to non-operative treatment in suitable cases. Every penetrating wound should be operated on because the diagnosis of perforation is sometimes impossible. Shock is not a contra-indication to operation. Promptness of

<sup>1</sup> *Precis de Chirurgie de Guerre*. By Edmond Delorme, Médecin Inspecteur General de l'Armée. Paris, Masson et Cie., 1914.

<sup>2</sup> *Annals of Surgery*, July, 1915, p. 7.

<sup>3</sup> *Press Médicale*, 1915, p. 221.

<sup>4</sup> Vol. lxv, p. 348.

<sup>5</sup> *Lyon Chir.*, 1915, p. 229.

<sup>6</sup> Paris Letter, October 14, 1915, *Journal of American Medical Association*, lxv, 1743.

operation is one of the principal elements of success. To obtain this promptness, rapid transportation is indispensable as well as the placing of an operating station, perfectly equipped, as near as possible to the firing line.

Elsewhere, Quenu<sup>1</sup> reported on 96 penetrating wounds of the abdomen treated by primary laparotomy, with a 55 per cent. mortality. Conservative treatment gave a distinctly higher mortality. As regards technique, it was found that closure of perforations of the large intestine by circular suture was much more dangerous and less effective than in perforations of the small intestine.

Finally, Rochard,<sup>2</sup> reporting on 84 penetrating abdominal wounds, stated that laparotomy was the only treatment applicable, either to wounds of war or to wounds of civilian life. It gave a mortality of 60 per cent., while non-operative treatment gave 80 per cent. He believed the most serious wounds are those of the spleen, the most benign, those of the liver. Between the two, are wounds of the intestines. Rupture of the intestine is more serious than section because of the copious outflow of the intestinal fluids. Section is more serious than a laceration which, however, is more serious than a perforation. The greatest number of deaths occur before the fifth day. Cases should not be considered cured until at least fifteen days have passed after laparotomy, and provided they seem to be progressing favorably at that late date.

ENGLISH. Rutherford Morison<sup>3</sup> says: "Of serious abdominal injuries, 20 per cent. are hopeless, and, of the remaining 80 per cent., not less than 60 per cent. should recover if an early operation under satisfactory conditions can be performed."

Surgery, if available, should be employed, provided the general condition permits it. The conservative treatment of rest, administration of opium and abstention from food and drink, is indicated when proper surgical assistance is not available.

"Ninety per cent. of bullet wounds of the abdomen perforate one or more of the abdominal organs. Failure to remember that in perforations of the hollow viscera, both walls are pierced, with consequent closure of the most apparent opening and failure to search for, find, and close the posterior one, has cost many lives."

In the critical review<sup>4</sup> of Morison's book, exception is taken to Morison's advocacy of the Murphy button in repair for laceration of the gut at the duodenojejunral flexure. Here one-half of the button is to be placed in the torn end of the duodenum and the other half in the side of the jejunum, the torn end of which is closed by suture. The

<sup>1</sup> Bull. et Mem. Soc. de Chir. de Paris, 1915, p. 1815.

<sup>2</sup> Paris Letter to Journal of American Medical Association, January 6, 1916, lxvi, 369.

<sup>3</sup> Oxford War Primers, 1915.

<sup>4</sup> British Journal of Surgery, October, 1915, p. 345.

critic asks what is to happen if the button drops back into the duodenum, and goes on to say: "It is just conceivable that there may be urgent military reasons in which the Murphy button might be found useful, but, if there is one place where it may never be used, it is surely the duodenojejunal flexure." The reviewer fails to see the justice of this criticism. Certainly a properly applied Murphy button would seem to offer as good chances, if not better, than a suture operation in this difficult and inaccessible region; and, granted that no leak occurred, supposing trouble *did* result, either from failure of the button to be passed onward (the shoulder on the half of the button to be placed in the distal portion of the anastomosis seems to have prevented this complication during the past few years), or from subsequent cicatricial contracture, the reviewer feels that the mortality from the second operation for relief of either of these relatively chronic conditions would certainly be less than the immediate mortality from attempts to repair the laceration at the duodenojejunal flexure by suture.

In passing, it is of interest to note the report of C. A. Pannett<sup>1</sup> upon naval surgery, who says: "In the abdomen, non-fatal cases have been confined to the parietes. There are no bullet wounds in the ordinary engagement at sea. It can easily be credited that the mortality, when the abdominal cavity is entered by an irregular shell fragment causing extensive havoc among the viscera, is very high and that death is not long delayed. Such cases do not reach the naval surgeon."

**GERMAN.** The same early conservatism later giving way to advocacy of prompt operative treatment (dependent upon improved transportation facilities) is to be noted in the German surgical literature.

At the meeting of the surgeons of the ninth army at Lodz, on January 20, 1915, Körte advocated conservative treatment of abdominal wounds. Perthes was also in favor of conservative surgery, but conceded that he operated within the first twelve hours provided that there were symptoms of perforation of the intestine, the condition of the patient permitted, and, that aseptic conditions could be established.

Borchard, in the discussion, brought out several points regarding the *pathological anatomy of abdominal gunshot wounds*. Wounds of the intestine have been known to heal of themselves. Bullets have been known to pass through the abdomen without injuring the intestines. This lucky occurrence has been more frequent with wounds from before backward than with those from side to side. Rigidity occurs more quickly in the presence of hemorrhage than in the presence of perforation. He, too, stated that the wounded man's chances are better under conservative therapy than where the operative asepsis and technic cannot be perfectly carried out.

<sup>1</sup> British Journal of Surgery, 1915, p. 469.

Under Körte, 47 per cent. died under conservative treatment, 58 per cent. under Perthes, and 63 per cent. under Borchard. Conservative treatment under the latter consisted of starvation for five days, with administration of normal saline either by rectum or subcutaneously. Small amounts of fluid were allowed by mouth. Those who advocated conservative therapy, however, stated that, under favorable circumstances, they would operate within the first twelve hours after injury. Complaints were made about the lack of transportation facilities.

The exigencies of war made it impossible to hold the customary annual April meeting of the Deutsche Gesellschaft für Chirurgie in Berlin. Upon the outbreak of war, every surgeon of note automatically became a military medical officer and was assigned to some base hospital where the fullest use could be made of his services. It would therefore have been impracticable to call these men from their posts back to Berlin, and so, for the sake of convenience, a meeting of military surgeons was held at Brussels on April 1, 1915; 1200 men were present.

In the course of a report upon operative technic, hemostasis, etc., Garré stated that a generalized rule for the treatment of abdominal gunshot wounds could not be formulated. Hemorrhages, perforations of the stomach and intestines must be operated provided operation under the proper surroundings could be performed. A prolapse of abdominal contents requires immediate reposition and tamponade. In the discussion upon gunshot wounds of the abdomen, the following speakers were heard:

Körte called attention to the following unfavorable factors in the problem of treating the wounded: (1) Artillery wounds were often so severe that it was folly to imagine any surgical aid might be of use. (2) Variations in the efficiency of transportation; thus, transport over frozen roads harmed the wounded much more than over good roads. (3) Hastily constructed field hospitals did not afford the proper environment for quiet, undisturbed performance of laparotomies. (4) The time element. Patients often came in more than twelve hours after being wounded, which naturally rendered prognosis more unfavorable. (5) The operator should be experienced in the proper handling of traumatic abdominal injuries. (Apparently this was not always the case.—REVIEWER.)

Körte's experience comprised 312 gunshot wounds of the abdomen, the majority of which were inflicted by infantry projectiles; 38 died in the field hospital. 274 came alive to the base hospital. Of these, 146 died, and 126 were then transported to the rear. There was a 60 per cent. mortality with conservative treatment; of 17 operated cases, 14 died. Ruge reported 60 gunshot wounds of the abdomen, 59 of which died. Autopsy upon these showed that only in 3 cases could an operation possibly have saved the patient. Rotter advocated imme-

diate operation; he saved 6 consecutive cases. Toepfer saved 6 out of 14 cases by operation. Barth was also in favor of operative treatment.

As at the earlier meeting in Lodz, Borchard, Perthes and Körte advocated conservative measures.

Rehn, senior, reported 400 cases conservatively treated with 70 per cent. recoveries. Among these were 38 infantry bullet wounds, with 32 spontaneous recoveries.

All the surgeons took care to exclude from their statistics wounds which did not cause perforation of the intestinal canal. Schmieden believed that barely 50 per cent. could be saved by conservative treatment. Prognosis of abdominal wounds was worse than those of head or chest. Stomach injuries gave a better prognosis than those of the intestine. Perhaps in the former the theory about closure by means of prolapsed mucous membrane, held, certainly not in the case of the latter.

Schmieden was in favor of early operation when this was possible. Of 198 cases, gastro-intestinal perforation was present in 157. Of 58 operated, 37 died and 16 recovered; of 99 treated conservatively, 72 died. Schmieden said that in analyzing these statistics one must take into account the number of those dying from rapid peritoneal sepsis in the very first dressing stations, and also the fact that many of the deaths among the 37 operative cases came from tetanus or gas bacillus infection, in short, from something which had nothing to do with the laparotomy.

Wounds of the liver and spleen showed a mortality of 50 per cent. Schmieden advocated stations equipped for laparotomy, four kilometers back of the trenches.

Frederich (who has since died of sepsis) reported 66 per cent. of recoveries with conservative treatment. The best results were in wounds of the liver and stomach, the worst in those of the colon. He reported 33 abdominal gunshot injuries among 1320 wounded. Of these, 5 remained alive. The mortality in the first twenty-seven hours was 85 per cent.

Enderlen reported 89 operations for injury of the gut, 77 of which he performed himself; 30 per cent. recovered. He never saw any tendency to spontaneous closure of perforations by prolapse of intestinal mucosa. Wounds of the large intestine gave the worst prognosis.

Kraske said that in spite of occasional good operative results, he was in favor of conservative treatment when the patients came in later than twelve hours, that was, in the case of army field operations, but advocated immediate operation where the circumstances, such as trench warfare rendered this possible—in other words, where laparotomy stations could be brought up close to the front so that operations could be done within twelve hours. Kraske already had such a laparotomy station set up under his control.

Sauerbruch (an advocate of immediate operation) reported 54 cases, with 23 recoveries.

Körte, in 23 autopsies, noted a number of instances in which suture of bladder wounds had been done, with failure to close the hole in the rectum made by the same projectile. There were 2 cases of simultaneous appendicitis, 1 of which was not diagnosed (see also report of Colley under Appendix.)

Of 23 wounds of the liver, 14 healed spontaneously, although secondary abscess formation or chronic biliary peritonitis could not be excluded. Landau<sup>1</sup> reported the following history. Three weeks after gunshot wound of the liver there was poor general condition, abdominal cramps, hiccup, meteorism, tympany over the entire abdomen; no icterus, no fever, no appetite. The stools were of normal color. The meteorism was amenable to enemata, but the progressive emaciation furnished the indication for laparotomy. Three liters of bile-stained fluid were evacuated; no peritonitis; rapid postoperative recovery.

In subsequent publications, the increase in experience demonstrated again and again the value of operative interference under proper indications.

Wieting Pasha<sup>2</sup> said that immediate operations in early cases gave the best prognosis. Wieting and Vollbrecht observed 120 recent gunshot wounds of the abdomen; 18 of these were thoracic-abdominal injuries, the entire course of which was observed from beginning to end. These authors call attention to the fact that the only reliable statistics must commence with the cases of immediate death on the battlefield, and end with those ultimately recovering or dying after transfer to the base hospital in the interior. It is of particular importance to include those immediately dying upon the battlefield as the result of abdominal wounds.

Wounds of the hypogastrium are more dangerous than those in the epigastric regions or in either side of the abdomen. Practically all of those who recovered had their bullet tracts lying above the level of the umbilicus, those who died, below it.

Läwen<sup>3</sup> observed that the results of expectant treatment were so poor that he resorted to operation whenever the general condition of the patient permitted it. He reported 42 cases. Of 21 treated without operation, but 1 survived. Of 21 operated on, 9 survived, the operation occurring from three to eleven hours after injury. Obliteration of liver dulness was an inconstant symptom (present 5 times in 11 cases of perforation of the intestine). Shifting dulness was also inconstant, except in the presence of a very large exudate and even here not always definite. Rectal examination for traces of blood as indicating injuries

<sup>1</sup> Berl. klin. Wehnschr., 1915, No. 4.

<sup>2</sup> Deutsch. med. Wehnschr., 1915, No. 33, p. 981.

<sup>3</sup> Bruns's Beitr. z. klin. Chir., Bd. xcvi, 1, p. 47.

of the large intestine was invariably made. Gunshot wounds of the liver, in which a simultaneous injury of the alimentary tract seemed unlikely, were expectantly treated. Wounds of the alimentary tract, if the patient's condition permitted, were operated on within ten hours after injury.

Wounds of the liver: 5 cases unoperated, all died; of 4 operated, 3 died. The bad results were due to injury of other intra-abdominal organs, as well as to severe injury of the liver. The longer the wound in the liver, the more severe was its injury. In one uncomplicated case of injury to the liver, a permanent biliary fistula resulted with constant discharge of bile into the abdominal cavity accompanied by extreme emaciation and desiccation. Injuries of the intestinal wall, even small ones, never showed any tendency to spontaneous contraction of the opening.

Läwen's technic was as follows: General anesthesia (ether or chloroform) was the rule. Morphine was not used because as a rule it had already been administered and the wounded seemed to be particularly susceptible to its influence. Depending upon the character of the injury a vertical or a right rectus incision was made. Transverse incisions seemed to be particularly useful in the lower abdomen; they were made at a level half-way between the umbilicus and the symphysis. The pouch of Douglas was usually drained. In addition to layer suture of the abdominal wall, several through-and-through silver-wire sutures were passed for the sake of additional security in case of possible further transportation. Although Läwen advocated absolute quiet until convalescence has been assured, yet in the event of further transportation of the wounded, he believed those whose intra-abdominal injuries had undergone recent operative repair stood a better chance of recovery than those who had not been operated upon.

*The enormously high mortality of abdominal wounds with penetration of the alimentary tract,<sup>1</sup>* is clearly brought out in a report by Perthes,<sup>2</sup> who states that the prognosis of wounds from infantry rifle bullets is in reality much graver than was believed in 1914.

The majority of fatal cases occurred within the first three days; 42 per cent. died in the dressing station; 75 per cent. of deaths occurred in the field hospitals in the first three days; 20 per cent. only reached the base hospital, and only 40 per cent. of those reaching the dressing stations (Feldlazaret) quitted these alive. Of the survivors, about one-half consisted of wounds in which no injury of the internal organ had occurred. The remainder, with slight injuries to the gut, always had complications. Naturally, in those late cases conservative treatment was the rule.

<sup>1</sup> See report of Rotter, reviewed in PROGRESSIVE MEDICINE, June, 1915, p. 67.

<sup>2</sup> München. med. Wchnschr., 1915, No. 1.

The opinions of Rotter<sup>1</sup> and Lange<sup>2</sup> coincide in principle with those of Perthes. Operation should be performed within the first twelve hours, provided the proper conditions could be maintained.

The report of Boit<sup>3</sup> tells the same tale. Of 50 injuries to the intestine treated conservatively, 42 died (84 per cent. mortality); in 30 infantry rifle wounds, 90 per cent. died. Most numerous were injuries from bullets traversing the abdomen from above downward. Most extensive were the wounds from short-range shooting, and from transverse wounds of the abdomen. Stomach wounds did relatively well under conservative treatment; only 2 out of 13 died. The higher the wound in the stomach, the better the prognosis. (Boit is not an advocate of conservative treatment; he favors early operation. The series reported were in wounded who reached him quite awhile after injury.)

The following series of reports clearly show the present trend of German surgical opinion:

Kraske,<sup>4</sup> emphatically states that he has not seen a single case of certain perforation of the alimentary tract which healed under conservative treatment. All died within a few days of peritonitis. Since trench warfare has set in, Kraske has seen about half the cases, coming to early operation with gunshot wounds of the intestine, recover. He is a strong advocate for having certain hospitals back of the lines devoted to nothing but abdominal work.

Rost<sup>5</sup> holds the same opinion, remarking that the statistics of conservative therapy are wholly erroneous; that the farther from the front a hospital is, the better are its statistics with conservative therapy. Like Kraske, he also emphasizes the necessity of being absolutely certain in distinguishing gunshot injuries of the abdominal wall from penetrating injuries of the alimentary tract. Lastly, he states that late deaths under conservative therapy after transport to base hospitals in the interior, furnish additional arguments against this form of treatment and against the fallacious statistics supporting it. Strauss<sup>6</sup> says that the reports of conservative treatment in which as high as 90 per cent. recoveries were obtained, belong to the realm of fancy. Those abdominal wounds which, at the time of their entrance, made a relatively good impression, remained alive. All the others without exception died under conservative treatment.

Sauerbruch and Enderlen<sup>7</sup> are strong advocates of operative treatment when the gastro-intestinal tract is wounded. They operated on 211 out of 227 soldiers brought in with abdominal wounds. 44.4 per cent. recovered. The proportion of cures increased from month to

<sup>1</sup> Med. Klin., 1915, No. 1.

<sup>2</sup> Bruns's Beitr., xvii, H. 3, p. 212.

<sup>3</sup> Deutsch. med. Wchnschr., 1915, No. 24, p. 707.

<sup>4</sup> München. Med., 1915, No. 22.

<sup>5</sup> Med. Klin., 1915, No. 25.

<sup>6</sup> Ibid., 1915, No. 25; Zentralbl., 1915, p. 656.

<sup>7</sup> Ibid., July 25, 1915, p. 823.

month as symptoms were recognized earlier, and the operations performed sooner. Enderlen employed the Fowler position, while Sauerbruch laid his patients flat on their backs after operation; no difference in the outcome could be detected. There were only eight mistakes in diagnosing intestinal injury where none existed; in these cases the operation was not followed by harmful results. Sauerbruch and Enderlen recommend no transport until four weeks after operation.

An interesting contribution to the PATHOLOGY OF ABDOMINAL TRAUMA BY PROJECTILES, is made by Karl.<sup>1</sup> He points out that contusions by projectiles may lead to no serious after-effects, or, with scarcely a mark on the abdominal skin, may have produced the gravest intra-abdominal damage, causing death within a few days from gangrene of the intestinal wall.

Penetrating wounds of the abdomen, with no wound of exit, cause less damage than those in which the bullet (infantry rifle or machine gun) has passed out again. In the latter the amount of damage depends on the velocity of the projectile and the degree of fulness of the viscera at the moment of impact. Infantry rifle bullets at 200 metres have an explosive effect, rupturing the abdominal viscera in all directions; at 400 metres such projectiles have been known to pass through the abdomen without inflicting serious damage provided the intestines happened to be empty.

The severest injuries have been sustained with the men kneeling or in the prone position at the moment of impact.

Krall<sup>2</sup> states that in extensive injury to the intestines it is safer to resect the injured loops and to bring both ends out upon the abdominal wall until symptoms of peritonitis have subsided.

All wounds from projectiles of low velocity (shrapnel, spent rifle bullets and shell fragments) are infected. Tangential wounds cause the least mortality; they vary from slight abrasions of the skin to larger defects of the abdominal wall.

RETROPERITONEAL INJURIES TO THE GUT FROM BULLET WOUNDS THROUGH THE BACK were reported by PEISER.<sup>3</sup> Infantry rifle bullets caused direct or indirect injury to the retroperitoneal portions of the gut. Even after closure of the intestinal fistula, the course is a protracted one, with sequestration of necrotic tissue. The prognosis, however, is good. Operation is only indicated in case the fistula fails to close of itself.

Kramer<sup>4</sup> also reported a case of retroperitoneal injury of the cecum from a penetrating bullet wound of the right ilium. The intestinal fistula promptly closed after removal of bone splinters and freeing of the intestinal wound from the margins of the hole in the bone.

<sup>1</sup> Deutsch. med. Wehnschr., 1915, p. 97.

<sup>2</sup> Deutsch. Ztschr. f. Chir., Bd. 134, p. 94.

<sup>3</sup> München. med. Wehnschr., 1915, No. 28.

<sup>4</sup> Zentralbl. f. Chir., 1915, p. 775.

THE COMPRESSION TREATMENT OF ABDOMINAL GUNSHOT WOUNDS. Kelling<sup>1</sup> suggests firm compression directly over the site of injury in wounds of the lower abdomen. His results in 6 rabbits were good. Kelling advises this as a sort of first-aid method for preventing extravasated contents from infecting the upper abdomen. (It may do for a few hours, but longer than this it will surely cause intestinal obstruction. Keeping the patient in a semi-upright position probably will be just as effective.—REVIEWER.)

Recent Contributions to the Diagnosis and Therapy of Ileus. THE X-RAY DIAGNOSIS OF POSTOPERATIVE ILEUS. According to Case<sup>2</sup> the Röntgen examination in postoperative obstruction of the small bowel is of the greatest value. Given a patient on the third day after operation with symptoms suggestive of acute intestinal obstruction, röntgenograms taken at this time will reveal at once whether there is gas distention of the bowel, and, if so, whether the distention involves the small or in the large intestine. Bismuth or barium is unnecessary at this time. Acute postoperative dilatation of the stomach may at once be ruled out. The small and large bowel may be distinguished by the characteristic outlines of the gas area. In acute colonic obstruction, the haustral markings, as well as the peripheral distribution of the gas along the course of the colon, are sufficiently characteristic to identify the large bowel. Equally characteristic is the appearance of the gas-distended coils in acute obstruction of the small bowel; the coils are more or less parallel and the caliber of the small intestine is increased to one and a half, to two, and sometimes to three inches. It is seen that the distention is not confined to a short segment of the intestine, but involves one or more feet of the small bowel, usually many feet. A certain amount of postoperative distention of the small bowel is frequently noted, although there are no symptoms suggestive of obstruction, however, in the serious cases, the degree of distention is at once apparent and suggestive (Fig. 19). Observation of the cecal region is especially helpful. If the cecum contains gas, it is not likely that the obstruction is in the small bowel. If the gas collections are seen to occupy the middle of the abdominal shadow, while the flanks are free of gas, it is probable that the obstruction is in the lower ileum, though not so low as the ileocecal region. When the gas areas occupy the true pelvis and the middle of the abdominal shadow, one may suspect the ileocecal region. Intussusception may be demonstrated by colonic injection with an opaque material. Early physical signs in these cases are very difficult to demonstrate, and by the x-rays, diagnosis is gained much earlier. In those cases where the gas-filled bowel gives no definite diagnostic aid, time will be saved by giving a

<sup>1</sup> Zentralbl. f. Chir., 1915, p. 241.

<sup>2</sup> Journal of American Medical Association, lxxv, 1648.

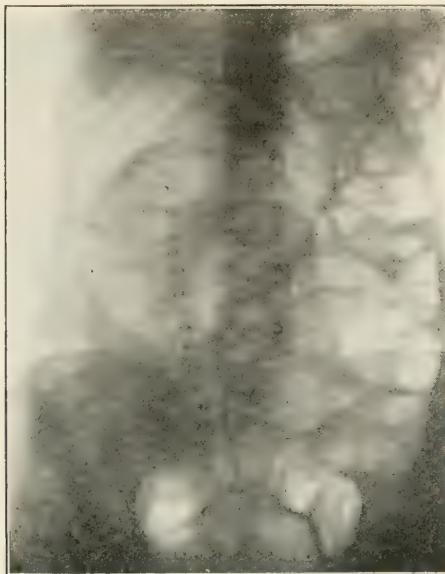


FIG. 19.—Very marked distention of the colon with gas in a case thought to be acute small intestinal obstruction. The gas distention was relieved by washing out the colon and the administration of pituitary extract. The distribution of the gas and the characteristic markings of the bowel outlines indicate colon rather than small bowel. (Case.)



FIG. 20.—Acute obstruction high up in the small intestine, somewhere near the junction of the jejunum and the ileum. Note the absence of gas-distended coils in the lower half of the abdominal shadow. (Case.)



FIG. 21.—Marked gastric dilatation. Acute obstruction low in the small bowel, yet a little distance above the ileocolic junction. One determines this by the distribution of the gas-distended coils. The trace of barium in the cecum remained there from a preoperative barium meal study. (Case.)



FIG. 22.—Very high-grade of acute obstruction near the ileocolic junction. The dilatation of the entire small bowel in this case was extreme. (Case.)

barium enema to rule out the possibility of colonic obstruction. If the entire colon is filled, one naturally recognizes that the obstruction must exist in the small bowel (Figs. 20, 21, 22, and 23). Case says with increasing experience, a decision can be rendered from the character and distribution of the gas areas which the abdominal shadow may present.



FIG. 23.—Acute obstruction in the small intestine in which the decision to operate was not made until the second examination, six hours after the first. Meanwhile a small amount of barium had been given and the characteristic appearance of the small bowel visualized. (Case.)

**Gastrostomy Instead of Permanent Gastric Siphonage.** Gross<sup>1</sup> became dissatisfied with the permanent gastric siphonage of Westermann.<sup>2</sup> Consequently, since 1905 he has used a simple gastric fistula for permanent drainage of the stomach. He establishes this in ten minutes under local anesthesia. The catheter remains *in situ* until recovery is absolutely assured. In case of recurrence of symptoms, the tube is simply reopened. With the better technic of the present, the disagreeable sequelæ—escape of gastric contents, etc.—need no longer be feared. After the first escape of gas and decomposed gastric contents, the patient is allowed to drink as much fluid as he desires. This immediately runs out through the gastrostomy tube and serves to wash out the stomach. Return flow from the obstructed small intestine

<sup>1</sup> Deutsch. med. Wehnschr., 1915, No. 26, p. 766.

<sup>2</sup> PROGRESSIVE MEDICINE, June, 1915, p. 68.

into the stomach is facilitated by the presence of this stomach-tube introduced through the fistula and by the suction effect of its siphonage. Gross establishes a gastric fistula as a routine in every operation for extensive diffuse peritonitis. He has employed it 47 times in the last two years (200 cases in all) and is very well satisfied with its results. It has given satisfaction in operations for perforated gastric ulcer. Intestinal fistulæ, with the exception of this gastric fistula, are rarely employed by Gross except in the extreme cases of stenosis from actual mechanical causes.

Shortly after Gross's publication, Nyström<sup>1</sup> wrote that permanent drainage of the stomach in peritoneal ileus was first suggested by Jaboulay,<sup>2</sup> and that Lennander repeated this in September of the same year (1905).

Nyström summarizes the indications for a permanent gastric fistula into the two following categories: First, in ileus it affords continuous drainage of the upper end of the alimentary tract. The distention of the upper abdomen is prevented. The diaphragm can move much more freely. The cardiac and respiratory movements are unhindered. The subjective condition of the patient is much improved. There is no vomiting. The uneasiness associated with distention is absent. Unlimited drinking is not followed by evil consequences. Conceding that not every case drained this way is saved from death, nevertheless Nyström says that the advantages offered by the gastric fistula may turn the scale in favor of recovery in many precarious cases of ileus.

Second, in operations on the stomach. The permanent fistula may be employed when security of the stomach suture is doubtful or when the condition of the patient does not permit of a gastro-enterostomy at the same sitting, as, for example, in far-gone cases of perforative peritonitis from ulcer.

In the cases of ileus taking a favorable turn, it is interesting to observe such a "turn." At first fecal-smelling intestinal contents stream out through the tube. Then the fluid becomes more bile-stained and less offensive; it still escapes in large quantities. Gradually the amount lessens until finally the gastric contents consist chiefly of fluids which have been swallowed. A certain amount of retention is present for a time; finally, this is replaced by the normal intragastric condition.

By means of the fistula it is possible to gauge the degree of gastric acidity and to vary dietetic and therapeutic measures accordingly.

Nyström advocates the Witzel method of gastrostomy. After passing the first sutures, the stomach is raised with two fixation forceps and the catheter, armed with a grooved, sharp-pointed cannula

<sup>1</sup> Zentralbl. f. Chir., 1915, p. 721.

<sup>2</sup> Lyon Méd., March 12, 1905, p. 560. In a case of volvulus of the small intestine with enormous gastric dilatation and atony. He employed it again in a case of intestinal obstruction a few months later.

(see Figs. 24 and 25), is introduced into the stomach without leakage. Perforation is facilitated by a tiny nick in the gastric serosa. As soon as the catheter has entered the stomach, it is held in place while the cannula is withdrawn, the groove permitting its ready removal from the catheter. The cannula is grooved instead of tubular in consideration of the fact that most catheters have a flaring posterior end much larger than the rest of their caliber. The stomach is purposely not sutured to the abdominal wall. The catheter is still further invaginated by a second set of sutures and is fastened to the stomach with chromic catgut. As a rule, the catheter can be removed at the end of a week, if prognosis is favorable at that time.

In a subsequent communication, Gross<sup>1</sup> says that he uses a tube 1 cm. in diameter instead of the thinner catheter (14 to 18 Fr.) advocated by Nyström. The disadvantage of widening of the fistulous tract with consequent leakage, is more than compensated by the benefits derived from the better drainage afforded by a tube of ample caliber (Gross).



FIG. 24.—Nyström's grooved, sharp-pointed cannula for introduction of gastrostomy tube.

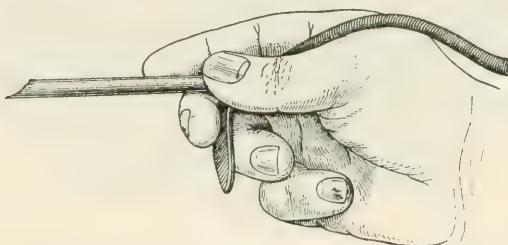


FIG. 25.—The same about to be thrust through the stomach wall.

**ILEUS DUPLEX** is a condition described by W. Sampson Handley<sup>2</sup> in which, as the result of a pelvic peritonitis, there is obstruction of the intestine at two points: first, in the ileum at a point about three feet above the ileocecal valve; second, in the sigmoid at the junction of its iliac and pelvic portions; in other words, at the points where the ileum and colon respectively cross the brim of the true pelvis to enter the pelvic cavity. The segments of paralyzed intestine are the portion of the ileum contained in the pelvis, that is, about the lower three feet excluding the last two inches, and, secondly, that part of the large bowel contained in the true pelvis, that is, the lowest portion of the pelvic colon and the upper part of the rectum.

<sup>1</sup> Zentralbl. f. Chir., 1915, p. 785.

<sup>2</sup> British Journal of Surgery, October, 1915, p. 161.

Ileus duplex does not occur in all cases of pelvic peritonitis. In some, the practically normal coils of the ileum are found bathed in pus, but here the peritonitis remains superficial and the wall of the gut does not become inflamed. In other cases, the bowel wall itself is swollen and edematous, the affected coils are empty, passively contracted and motionless. The suprapelvic small bowel, though quite uninflamed, is greatly distended owing to the obstruction lower down.

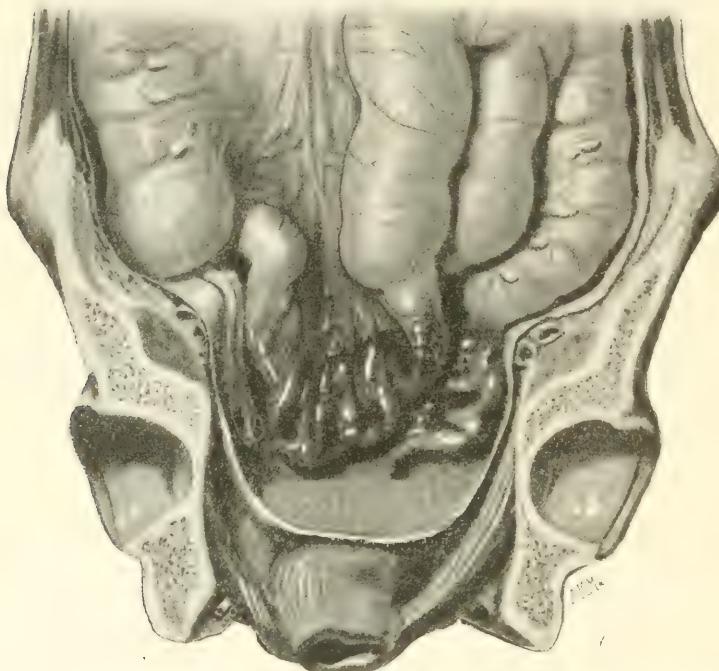


FIG. 26.—Ileus duplex arising from gangrenous pelvic appendicitis. The pelvis is occupied by a pool of pus bathing the inflamed pelvic ileum and pelvic colon. The last two inches of the ileum are normal. The suprapelvic ileum is much distended, but is neither paralyzed nor inflamed. A fairly sharp line separates it from the inflamed portion of the ileum. There is no peritonitis above the pelvic brim. (Handley.)

The terminal two inches of the small intestine, extending from the brim of the pelvis to the ileocecal valve, are usually collapsed and normal. That portion of the large bowel between the ileal obstruction and the obstruction in the pelvic colon contains some flatus but is neither collapsed nor distended (Fig. 26).

Handley believes the condition worthy of special consideration, first, because, though curable by appropriate treatment in the earlier stages, these often pass unrecognized under the pseudonym of general peri-

tonitis; secondly, because the duplex character of the obstruction has not been hitherto appreciated, and, thirdly, because failure to appreciate the true condition has been reflected in imperfect treatment.

*Etiology.* Appendicitis is the commonest cause of ileus duplex, and the special liability of pelvic appendicitis to give rise to ileus duplex joins with the ambiguity of its earlier symptoms to make it perhaps the most dangerous form of the disease. Handley believes that its present mortality can be appreciably lowered by a general recognition of the danger. Again, in military surgery Handley believes that cases of ileus duplex have occurred unnoticed, particularly where a septic bullet wound, piercing the bladder or injuring the pelvic cavity, has infected the pelvis. The pelvic peritonitis, thus set up, might easily cause paralysis of the ileum and pelvic colon. In such cases, the earliest signs of intestinal obstruction should be the signal for surgical intervention of the kind described below. Other causes are septic conditions of the pelvic genital organs or infection secondary to carcinoma of the rectum or cervix.

Handley states that autopsy will not reveal the true course of the morbid changes in ileus duplex. During the early stages, as seen by the surgeon, two processes can be recognized. They are running a race. One is spreading peritonitis of pelvic origin, the other, intestinal obstruction. Upon opening the abdomen in early cases, the surgeon notices the obstruction well ahead, and there is no peritonitis above the pelvic brim. In the postmortem room stage, the peritonitis has overtaken and more or less obscured the obstruction, inasmuch as "obstruction ends in peritonitis and peritonitis in obstruction, it may pass the wit of man to say after death, which was the primary or secondary cause thereof."

The *symptoms* are those of acute intestinal obstruction superposed on those of pelvic inflammation. Vomiting, though not invariably an early symptom, is almost a constant one. Repeated vomiting, cessation of flatus in spite of enemata, furnish the indication for a secondary operation. Visible peristalsis is absent; abdominal rigidity also absent except in the hypogastric region. The distention due to the obstruction must not be mistaken for the abdominal rigidity.

To distinguish between ileus duplex and general peritonitis, one must remember that in general peritonitis, general rigidity of the anterior abdominal wall is the rule; in ileus duplex, rigidity is absent, or present only in the hypogastric region. "General peritonitis means general paralysis of the intestine and is accordingly not amenable to surgical treatment. But, if the peritonitis is partial, though unlimited by any adhesion barrier, certain segments only of the intestine are paralyzed. If these segments can be thrown out of circuit by surgical measures, recovery in such cases is possible and even likely."

The *treatment* of ileus duplex, according to Handley, consists in

ileocolostomy combined with cecostomy. The latter need not be more than the tying in of a catheter (Fig. 27). "If, during this period, provision is made for the escape of gas, it appears to be unnecessary to provide for any evacuation of solids, consequently a full-sized colostomy opening need not be made." Handley uses a self-retaining, female catheter. Should this become blocked, it can be cleared by syringing through it a small amount of fluid. The catheter will come out spontaneously about the fifth day and the small cecal fistula which remains will rapidly close as soon as it has become superfluous.

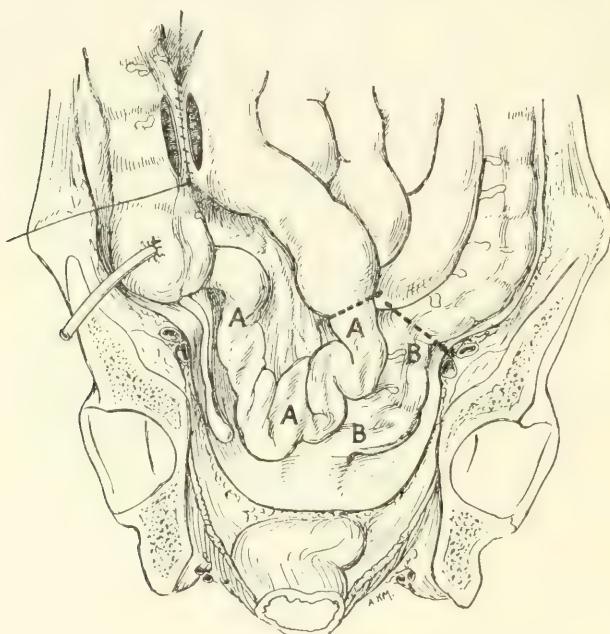


FIG. 27.—To illustrate the treatment of ileus duplex by ileocolostomy combined with cecostomy. A catheter has been tied into the cecum. A A A, paralyzed portion of small intestine. B B, paralyzed portion of large intestine. The dotted lines indicate the level of obstruction in the ileum and in the pelvic colon. (Handley.)

Handley adduces a series of 14 cases in the first 11 of which the mortality was very high. In the last three, with ileocolostomy and cecostomy, his mortality was *nil*.

**THE FOLLY OF ILEOSIGMOIDOSTOMY FOR THE RELIEF OF INTESTINAL OBSTRUCTION CAUSED BY GROWTHS SITUATED BETWEEN THE CECUM AND SIGMOID.** Morison<sup>1</sup> reminds his readers that although he first called attention to this subject in 1904, yet, at the present time, twelve years later, this faulty method is actually taught in some

<sup>1</sup> British Journal of Surgery, October, 1915, p. 336.

medical schools and is advocated in recent text-books. If the obstruction exists in the colon and an anastomosis is made between the ileum and the colon below the obstruction, the cecum is likely to burst or perforate, if the obstruction is complete, and if the ileocecal valve is competent (Fig. 28). This catastrophe will happen even if the ileum is not divided, because most of the intestinal contents will pass by the anastomotic opening and follow their normal route. If the ileum is divided, the rupture will be delayed but not prevented.<sup>1</sup>

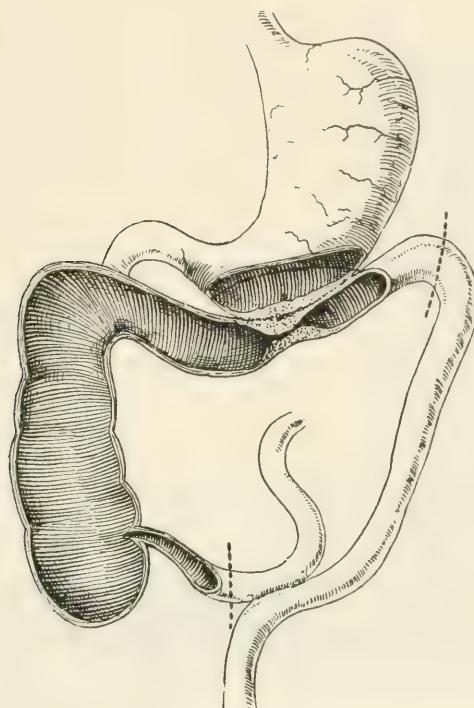


FIG. 28.—The inefficiency of ileosigmoidostomy for relief of obstruction of the transverse colon. The growths in the transverse colon is adherent to stomach. The portions excised are indicated by dotted line. (Morison.)

SUGAR INSTEAD OF SALINE INFUSION. A 4.5 per cent. solution of grape-sugar is advocated by Strauss.<sup>2</sup> Woodyatt and Sansum and Wilder<sup>3</sup> describe prolonged and accurately timed intravenous injections of glucose. In giving such intravenous injections two things are to be avoided, namely, too great dehydration on the one hand, and heart

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1915, pp. 143 and 153.

<sup>2</sup> Therapie de Gegenwart, October, 1915; Journal of American Medical Association, lxxv, 1859.

<sup>3</sup> Journal of American Medical Association, lxxv, 2067.

failure from imposing too much mechanical work, on the other. These can both be avoided by knowing the number of grams of glucose which enter the body hourly, and, what volume of water is moved by such a rate of sugar injection. In other words, the problem is to find the greatest rate at which glucose can be injected into a vein steadily without causing any glycosuria. They state that a normal rabbit or man can utilize between 0.8 and 0.9 grams of glucose per kilogram of body weight and hour of time without glycosuria for an indefinite period.

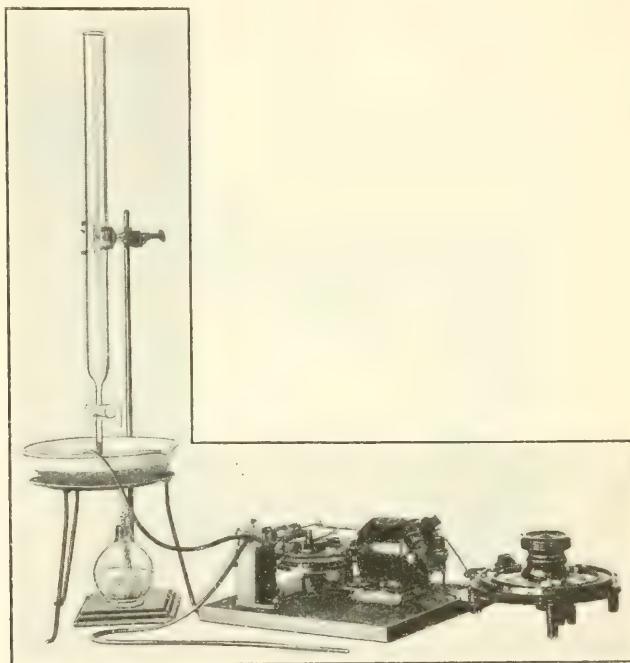


FIG. 29.—Apparatus for intravascular administrations. On the right is the quantitative intravenous pump with rheostat for motor speed control; the solution is drawn from a buret which may be more slender than that shown, and fitted with a side neck leading to a second buret of large capacity to facilitate refilling. The rate of injection is checked at intervals by readings on the buret, and corrected if necessary by touching the rheostat. The flame and bath on the left warm the solution. The delivery tube lies in front. (Woodyatt, Sansum and Wilder.)

These authors have devised an apparatus which assures uniform intravascular administration at a precisely controlled and predetermined rate for long periods of time (Fig. 29). This apparatus consists of a glass syringe barrel with a metal piston provided with a piston ring (Record syringe), the barrel being fixed while the piston is actuated by a piston rod from an eccentric on a power shaft. The latter is driven by an electric motor through a worm and gear which reduces

the speed of the motor and increases the power correspondingly. On the nozzle of the syringe there is a two-way, all-metal valve of special design which is turned automatically by a cam shaft, and alternately permits an influx and outflow of fluid to or from the pump barrel. The rate at which the machine delivers fluid is controlled in three ways: First, by the size of the barrel, which is interchangeable, so that any capacity can be used from 0.5 to 10 c.c.; second, by a device which regulates the stroke of the piston to any desired length from a millimeter up, and, third, by a rheostat with which the motor speed can be controlled delicately while running, so that the pump makes any desired number of strokes per minute between 15 and 60.

**RECTAL FEEDING.** Adler recommends four to eight ounces of pепtonized milk with one pint of 4 per cent. sugar solution three times daily, given by the Murphy drip method. He states that this can be kept up for two weeks without discomfort. In a few cases it has caused cramp-like pains during the first day or two.

In order to obtain some idea of absorption by rectal feeding, metabolism investigations were made in cases of gastric and duodenal ulcer with no abnormality of nutrition. After the second day of artificial feeding, with nothing by mouth, for from four to six days the colonic intakes in nitrogen were compared with the output in the urine and the return loss by rectum. The average total loss of nitrogen by urine and stools in five cases was 12.9 grams by day. The largest amount of nitrogen which Adler was able to supply daily by rectal feeding was 3.9, of which 2.06 grams were returned with stool. The average amount of nitrogen absorbed was 1.14 grams per day. "When we compare the amount of nitrogen lost by these cases, with the amount it was possible for them to absorb by colonic feeding, we realize how little we accomplish. Over the period of time that rectal feeding is usually carried out it is from a practical standpoint an almost negligible quantity.<sup>1</sup>

**HORMONAL AND NEOHORMONAL.** Dencks<sup>2</sup> reports a series of 40 animal experiments, and 120 observations upon patients. According to this extremely enthusiastic advocate of the preparation, its effects both upon animals and upon human beings were the same, regardless of whether it was administered intravenously or intramuscularly. It not only caused immediate peristalsis, but also cured long-standing, habitual constipation. Neohormonal caused none of the untoward symptoms produced by the original hormonal, such as lowering of blood-pressure, increase of temperature, vertigo and vomiting. As a rule 20 c.c. is given intramuscularly. If no effect was obtained within six to twelve hours, it was repeated, perhaps intravenously. In extreme paresis of the intestine where immediate effect was desired, intravenous

<sup>1</sup> American Journal of the Medical Sciences, October, 1915, p. 562.

<sup>2</sup> Deutsch. Ztschr. f. Chir., Bd. 132, p. 37; Zentralbl., 137.

injection was made with a Record syringe, the injection being made very slowly; this to be repeated within four to six hours. In extreme cases 30 to 40 c.c. was given intravenously, then 20 to 40 c.c. after six to twelve hours. (It is to be noted that the effects of hormonal were aided by the use of enemata, applications of heat, etc., as well as physostigmine and atropin.—REVIEWER.)

**EXPERIMENTAL STUDIES IN TOXEMIA FROM INTESTINAL OBSTRUCTION** Whipple<sup>1</sup> has isolated a primary proteose from the fluid above an intestinal obstruction, from a closed washed loop of small intestine, and from the mucosa of a closed loop or a loop draining externally through an enterostomy wound. Stripping or destroying the mucosa prevents the absorption. The poison is eliminated in the urine. The injection of the proteose causes a great rise in the incoagulable nitrogen of the blood. The amount of increase of this incoagulable nitrogen varies directly as the intensity and rapidity of the intoxication.

According to Murphy and Brooks,<sup>2</sup> the reason for the more acute symptoms in obstruction of the upper intestines is accounted for by the more abundant secretion into the upper bowel, with a more rapid distention and consequent circulatory disturbance of the bowel wall.

**Peritonitis. THE MORPHINE TREATMENT OF PERITONITIS.** As a result of experimental researches, Crile<sup>3</sup> believes that general peritonitis produces histological changes in the brain, suprarenals and the liver identical with those characteristic of exhaustion from any cause, such as running, fighting, trauma, etc. Furthermore, he believes he has found that morphinization prevents the histological changes which are characteristic of excessive conversion of energy, *i. e.*, of exhaustion. In other words, an artificial hibernation. Crile refers to the morphine treatment of older clinicians, such as Alonzo Clarke and Flint, who gave morphine until the respirations were as low as ten or twelve per minute. To this conservation of energy by the use of morphine, he adds the maintenance of water equilibrium by the Murphy proctoclysis.

**EXPERIMENTAL EVIDENCE IN FAVOR OF THE VALUE OF FOWLER'S POSITION IN PERITONITIS.** The lymphatic drainage of the peritoneal tract was studied by Woolsey in a series of 50 guinea-pigs.<sup>4</sup>

From 3 to 5 c.c. of a suspension of moist lampblack in salt solution were injected at the lowest possible point in the peritoneal sac of guinea-pigs. Within five minutes, the pigments were found to have reached the superior retrosternal node, at the junction of the first rib and sternum, and in some cases even the bronchial lymph nodes.

The absorption occurred by a process of translocation through the cells of the diaphragmatic mesothelium, and, later, through the agency

<sup>1</sup> Journal of American Medical Association, 1915, lxv, 476.

<sup>2</sup> Reviewed in PROGRESSIVE MEDICINE, December, 1915, p. 93.

<sup>3</sup> Surgery, Gynecology and Obstetrics, April, 1915, p. 415.

<sup>4</sup> Annals of Surgery, March, 1915, p. 291.

of leukocytes. The pigment having passed the peritoneal mesothelium, is conveyed through the endomysial tracts throughout the diaphragmatic musculature to the lymphatic radicles on the pleural surface of the diaphragm. From these through the various diaphragmatic gland groups to the costoxiphoid glands of Sappey, and from there through the retrosternal chain of lymphoid tissue to the subclavian vein or thoracic duct.

Woolsey found that the tissues of the diaphragm take a distinctly active part in the absorption from the peritoneal sac, and that other areas of parietal peritoneum functionate little, if any, in the lymphatic absorptive process. Consequently, the postoperative postural treatment of pelvic peritonitis, as advocated by Fowler, has definite pathological foundation.

**ETHER LAVAGE OF THE PERITONEAL CAVITY.** Pope,<sup>1</sup> from experiments on rabbits, concludes that whether or not the peritoneum be infected, to treat it with ether, is a highly improper procedure.

**The Elective Localization of Streptococci with Special Reference to Intra-abdominal Lesions.** E. C. Rosenow<sup>2</sup> states that streptococci from various diseases often have a most striking affinity for the organs or tissues from which they are isolated. Thus, in appendicitis, ulcer of the stomach or duodenum, cholecystitis, rheumatic fever, etc., the strains isolated upon injection into animals showed marked affinity for the appendix, stomach, gall-bladder or joints respectively, that is, lesions were produced in these organs to the exclusion of others. In many instances in which the animals survived the injections of bacterial suspensions for some time, no other focal lesions could be found save those in the organs in question; and, when the animals died early, these lesions were the chief feature and the associated ones were relatively insignificant.

Rosenow found that cultures from crypts of the tonsils or pyorrhreal pockets, contained streptococci having elective affinity. In acute diseases (such as appendicitis, ulcer of the stomach, cholecystitis) this elective affinity was only present at the time of the attack. In chronic diseases (such as rheumatism), this elective affinity was present for months. Such affinity was not as marked in the strains isolated from the supposed primary focus, that is, tonsils or pyorrhreal pockets, as in the strains isolated from lesions of the various organs, such as stomach, appendix, etc. Rosenow has found that virulence is a factor in localization. Thus, the strains from appendicitis are the least virulent, those from ulcer more virulent, from cholecystitis still more so, and the most virulent are those causing acute hemorrhagic pancreatitis. As is well known, virulence is increased by repeated

<sup>1</sup> California State Journal of Medicine, June, 1915.

<sup>2</sup> Journal of American Medical Association, lxv, 1687.

passage through animals, and is decreased by growth upon artificial media. Rosenow states that the occurrence of ulcer and cholecystitis became greater as the strains from the appendix were passed through animals, and appendicitis occurred oftener after the strains from ulcer and cholecystitis lost their virulence through cultivation on artificial media. None of the strains from appendicitis produced pancreatitis and only a few of the strains from ulcer and cholecystitis when isolated produced pancreatitis. But, after animal passage, pancreatitis occurred in 15 to 19 per cent., while after cultivation on artificial media pancreatitis was not obtained in any case.

In support of this theory of elective localization, Rosenow says: "The organotropic condition of streptococci is analogous to the affinity of the tetanus toxin for the motor ganglion cells, of the diphtheria bacillus for the faucial tonsils, of the meningococcus for the meninges, of the pneumococcus for the lungs, of the typhoid bacillus for lymphatic tissues, of the virus of rabies for the central nervous system, of the organism of anterior poliomyelitis for the anterior horns of the spinal cord, of the malarial parasites for the red blood corpuscles and of the trichina spiralis for muscles." In support of this he points out that the growth of bacteria in various organs may be related to function and blood supply. Thus streptococci of low virulence, but highly sensitive to oxygen, are found to produce lesions in tissues whose blood supply, and therefore oxygen and food requirements, are low (heart valve, tendinous portion of muscles and structures about joints). Streptococci of greater virulence are found to produce lesions in tissues whose blood supply, and therefore oxygen and food requirements, are high (kidney, lung, etc.), hence localization and the production of injury seem to be closely related to the amount of available oxygen in a given tissue. Again, although the circulation is an important factor in determining localization, Rosenow<sup>1</sup> believes the tissues themselves play an even more important role. "It seems as though the cells of the tissue for which a given strain shows elective affinity, take the bacteria out of the circulation as if by a magnet—adsorption. This remarkable trophic condition tends to disappear quite promptly, both on cultivating the streptococci on artificial media and on passing them successively through animals." The less virulent the strain, the more marked is monotropism, *i. e.*, affinity for one organ. In the more virulent strains from acute lesions, and after animal passage, this tendency is highly developed, the lesions occurring over a wider range—polytropism. Chronic foci of infection play a most important role in causing systemic disease. "A focus, such as a pocket in the tonsil, which cannot heal for mechanical reasons, and which is constantly filled with pus and necrotic material teeming with bacteria, must be regarded, in the light

<sup>1</sup> Journal of Infectious Diseases, March, 1915, p. 240.

of these findings, as a culture tube with a permeable wall affording abundant opportunity for the entrance of bacteria and their products."

In 10 out of 14 duodenal ulcers examined in infants, Gerdine and Helmholz<sup>1</sup> found diplococci in the ulcer base in such numbers that they were presumably of etiological significance. Their investigations seem to confirm the work of Rosenow.

In spite of Rosenow's attractive and plausible theories, we must await confirmation of his findings by other competent investigators before accepting his views.

**Peritoneal Adhesions.** THE EXPERIMENTAL PREVENTION OF POST-OPERATIVE ADHESIONS were studied by Sweet, Cheney and Willson.<sup>2</sup> As preliminary control they used a series of five dogs upon which end-to-end anastomoses, with or without omental plastics, etc., were done. At subsequent autopsy, little, or no adhesion-formation was found.

In the next series 100 c.c. of *sterile paraffin oil* were injected into the abdominal cavity ten minutes before opening the abdomen, so that the entire peritoneal surface would become thoroughly coated with a film of oil before being exposed to the air. Later on, *sterile olive oil* was used, and, lastly, paraffin oil of a high-grade purity. In only 1 out of the 11 cases in which some type of oil was used, was there freedom from adhesions or peritonitis. In all of the 11 cases, more or less extensive exudation was present. In 7, out of the 11, the phagocytic index was tested, and in 6 of these the index was markedly reduced and even in this remaining case some reduction was present. The average index was 4:17. From these findings, the authors deduced that oil in any form causes an intense exudation of leukocytes into the abdomen and these are inhibited from their normal physiological functions by the presence of the oil, as indicated by the low phagocytic index. Thus it can be stated, that oil is contraindicated, if for no other reason than that anything which causes local migration of leukocytes and then checks their action, simply increases the bulk of foreign material with which tissue has to deal. That the oil is gradually absorbed by the lymphatics is shown by the presence of oil droplets in the lymphatics of the mesentery and broad ligaments in cases allowed to go for a long period.

*Citrate solutions* were then employed in 7 cases. In these, as in the previous series, end-to-end anastomoses were performed, but just before closing the abdomen 50 c.c. of a 3 per cent. citrate solution in normal saline solution, were emptied into the cavity. It was noted at the time of operation that even with this small amount, some of it ran over the edges of the abdominal wall which caused marked oozing in each case, making the closure of the wound more than usually

<sup>1</sup> American Journal of Diseases of Children, December, 1915, No. 6, p. 397.

<sup>2</sup> Annals of Surgery, March, 1915, p. 297.

difficult. In this series there was not a single satisfactory result. Two deaths occurred, one from peritonitis, the other from the splitting open of the abdominal wound. In none of these was there satisfactory wound-healing.

These results upon dogs were just the opposite of those obtained by Pope<sup>1</sup> with the same solution upon rabbits. In his work, adhesions were limited, and the wound-healing, normal. Moreover, it is pointed out that, in the present series upon dogs, the gut was opened in the course of performing entero-anastomosis, while in Pope's series the peritoneum was merely scarified and there was no possibility of infection. Sweet, Cheney and Willson concede that the use of citrate may have a field where infection can certainly be excluded, but they point out the great danger which would follow if a focus of even mild latent infection were opened in the presence of citrate solution. Here citrate would interfere with the first steps in the removal of infection from the peritoneal cavity, namely, gluing of the bacteria to the omentum by lymph.

The citrate is also held to limit the normal production of plastic lymph, so that leakage may take place through the lines of intestinal sutures and a minor degree of infection follow with the later production of adhesions, there being insufficient infection to set up a definite peritonitis.

It is justly pointed out that the process underlying the formation of adhesions is a part of the process of the normal repair of all wounds of serous surfaces, namely, the pouring out of the plastic lymph which seals the lips of the wound. The object, therefore, is not the *prevention* of adhesions but their *limitation* by preventing the coagulation of lymph and the agglutination of serous surfaces. With citrate the wound remains unsealed and entrance of bacteria from the intestinal lumen into the peritoneum is unhindered. In short, the only way to prevent adhesions is to minimize trauma.

Walker and Ferguson<sup>2</sup> consider that the best solution is sodium citrate 3 per cent., and sodium chloride 1 per cent. Such hypertonic citrate solutions do at times prevent peritoneal adhesions after laparotomy. They advise the use of gauze soaked in citrate for packing off the intestine. The use of citrate will not prevent adhesion formation as a result of trauma, infection of large areas left denuded of peritoneum, or after contact of intestines with the iodine-painted skin, or contact with dry gauze. In one of their series of experiments these authors broke up postoperative adhesions and introduced hypertonic citrate solutions of varying strengths in 18 experiments. In only 1 case was there complete success. In 22 per cent. the cases were benefited by the treatment but still had a few adhesions.

<sup>1</sup> PROGRESSIVE MEDICINE, 1915; June, 1914, p. 79.

<sup>2</sup> Annals of Surgery, February, 1916, p. 198.

In his most recent communication Saxton Pope<sup>1</sup> reports using a 2 per cent. citrate of sodium with 2 per cent. sodium chloride in 400 abdominal sections. All sponges and gauze pads were moistened with this solution. In 20 cases, from four ounces to a pint was left behind in the abdominal cavity. The procedure caused pain and partially roused the patient, hence the incision was nearly closed before introducing the liquid.

Terry, in the discussion, mentioned the use of Pope's solution of sodium citrate and sodium chloride, stating that he was much pleased with its effect. He used the hypertonic solution in large quantities, which appeared to minimize adhesions, as several secondary laparotomies have shown.

Brinsmade<sup>2</sup> uses sheets of rubber covered by gauze believing them to do less harm than moist sponges and still less harm than dry sponges.

**Free Omental Grafts in Abdominal Surgery.** Freeman<sup>3</sup> advocates their use in the replacement of lost portions of peritoneum, the prevention of adhesions, the strengthening of suture lines in operations upon the stomach and intestines, pyloric occlusion, the checking of hemorrhage from raw surfaces, especially of the liver, spleen, and pancreas. He calls attention to the following details of technic: The avoidance of mass ligatures, the use of the free border of the omentum rather than the part nearer the great vessels to avoid ligature of the latter, the removal of no more tissue than is actually necessary, the anchoring of the grafts with fine catgut sutures to prevent their shifting, the use of a sufficiently large transplant to cover the raw area and project beyond its margins on every side.

Resection of the omentum has been found to cause one of four conditions. (1) Multiple foci of hepatic necrosis, (2) gastric and duodenal hemorrhage, (3) adhesions of the omental stump. Freeman has been satisfied with his clinical results, but concedes that he has had no opportunity for control observation, and therefore has no first-hand knowledge about the ultimate freedom of the omental graft from adhesions.

**Subcutaneous Drainage of Ascites.** Every year new technical modifications of this idea are published. (See previous articles in this section of PROGRESSIVE MEDICINE for June.) This year Schepelmann<sup>4</sup> uses tubes made of calves' aortas hardened in 10 per cent. formalin. These tubes are passed into the peritoneal cavity through the abdominal wall in an oblique manner. The operation is performed under local anesthesia, one drain being inserted on each side. Schepelmann had four cases, and reports that there was immediate relief.

<sup>1</sup> Annals of Surgery, February, 1916, p. 205.

<sup>2</sup> Journal of American Medical Association, lxxv, 920.

<sup>3</sup> Annals of Surgery, January, 1916, p. 83.

<sup>4</sup> Arch. f. klin. Chir., 1915, cxi, 663.

**Surgery of the Great Vessels of the Abdomen.** LATERAL SUTURE OF THE ABDOMINAL AORTA. Juvara,<sup>1</sup> of Bucharest, accidentally made a wound of one centimeter in the aorta while removing a retroperitoneal sarcoma. The wound was sutured with fine linen thread. This repair caused a slight narrowing of the lumen. Uneventful convalescence was rather remarkable considering the age of the patient, a woman of seventy-two years.

EMBOLECTOMY OF THE ABDOMINAL AORTA is reported by Konjetzny.<sup>2</sup> The operation was performed thirty-six hours after onset of symptoms. After transient improvement the patient died of heart failure three days after the operation. At autopsy, the aortic suture was found in perfect condition, no thrombosis. The aorta and the adjacent iliac arteries were free from thrombi, but the external iliac and femoral, as well as their accompanying veins, were filled with clots. In his experimental work Konjetzny found that, after ten to fifteen hours, the changes in the vessel wall with consequent desquamation of the intimal cells led to coagulation of the stagnated blood in the vessels, hence the reformation of thrombi even after clearing of the vessel's interior. The opening of the aorta itself and subsequent sutures does not entail any great mortality, provided the operation is performed shortly after the onset of symptoms and no further emboli are formed.

A similar experience was recounted by Stewart.<sup>3</sup> The patient was a woman aged forty-nine years, giving a previous history of acute articular rheumatism some years before. The patient was admitted to the hospital in very poor condition with a blurred sensorium. Heart enlarged and very irregular in action; apex 13 centimeters from the median line; presystolic thrill and murmur present. Pulsation present in the abdominal aorta; none in the external iliacs or in any of the arteries of the lower extremities. The right foot was black and shriveled. The lower two-thirds of the right leg was purplish. The left leg was pale, painful, tender and useless. No fever. There was advanced progressing gangrene of the right leg, with prodromal symptoms of gangrene of the left leg. The diagnosis was embolus in the right femoral artery some time preceding embolus at the bifurcation of the aorta, or that an embolus had been arrested at the bifurcation of the aorta which had completely occluded the right iliac and only partly the opening of the left common iliac at first, which later became completely obstructed. At laparotomy, the iliacs were motionless, the aorta pulsated to a point near the bifurcation, at which point it was hard. While an assistant compressed the aorta with the finger above, a longitudinal incision of three-quarters of an inch was made in the anterior wall of the aorta just above the bifurcation. A recent clot protruded

<sup>1</sup> Rivista de Chir., June, 1914.

<sup>2</sup> Zentralbl. f. Chir., 1915, p. 753.

<sup>3</sup> Annals of Surgery, May, 1915, p. 526.

into the left common iliac artery. An older clot was uncovered and easily forced through the wound by pressure from below on the right common iliac artery; wound closed, pulse returned in both femoral arteries. The patient died on the third day from cardiac weakness and pulmonary edema. No autopsy was obtained.

A REMARKABLE INJURY TO THE INFERIOR VENA CAVA BY A SHRAPNEL BALL was observed by Kaphe.<sup>1</sup> The soldier lived sixty-two hours after being wounded. At autopsy, it was found that the ball had traversed the liver and had injured the inferior vena cava, causing a large effusion of blood in the abdominal cavity. The intestine was uninjured. A diffuse peritonitis was present; the obvious source of infection being the grains of sand and bits of uniform found upon the under surface of the liver. Inasmuch as the patient lived sixty-two hours after injury, death was due to the peritonitis and not to hemorrhage.

**Operations Upon the Abdominal Sympathetic** are still in the realm of experimental surgery. Leriche<sup>2</sup> refers to a stretching of the solar plexus for the gastric crises of tabes by Jaboulay fourteen years ago. In his own case the technic was as follows: Supra-umbilical median laparotomy; exposure of the aorta through the lesser omentum. Exposure of the celiac axis and its branches, as well as the upper margin of the pancreas. All branches of the sympathetic were divided, as well as those of the vagus, followed by extensive massage of this region. Transient relief was followed by recurrence within four or five weeks. Leriche then made a posterior root resection according to Foerster. Leriche says that operation upon the peripheral sympathetic is indicated in gastric crises where the parietal element, such as increase of abdominal reflexes, hyperesthesia of the chest and intercostal neuralgia are absent; also in the presence of a characteristic vagus crisis.

#### THE STOMACH AND DUODENUM.

**Recent Advances in Röntgenological Technic and Diagnosis.** In England the standard opaque meal for radiographic examination of the alimentary canal is as follows: It consists of either bread and milk, or porridge. Two ounces of bread without the crust cut into small pieces over which eight ounces of ordinary milk or malted milk, which have been boiled in a separate vessel with two ounces of bismuth oxychloride or two ounces of barium sulphate, are poured. This mixture is stirred as it is poured over the bread, and sugar is added to taste. When porridge is used, seven ounces of fine oatmeal porridge are mixed with two ounces of bismuth oxychloride or similar amount of barium sulphate, and enough milk added to make up ten ounces. Patient can

<sup>1</sup> Deutsch. med. Wehnschr., 1915, p. 284.

<sup>2</sup> Deutsch. Ztschr. f. Chir., Bd. 131, p. 77.

add as much sugar as he cares. The total bulk of the meal should be about half a pint. The meal should be taken as nearly as possible on an empty stomach. No cathartic or other medicine should be taken within thirty-six hours of the first examination, and, if the bowels are not open naturally, an enema should be given on the morning of the examination. Bismuth oxychloride is slightly more opaque to the Röntgen rays than bismuth carbonate. The oxychloride is about one and a half times as opaque to the Röntgen rays as an equal weight, and twice as opaque as an equal bulk, of barium sulphate. Barium sulphate is preferable because it is much cheaper, and is equally good for radiographic examination as bismuth oxychloride. By using barium sulphate, Guy's Hospital has saved about fifty pounds (£50) per year. The barium sulphate must be absolutely free from soluble barium salts, which are decidedly poisonous.<sup>1</sup>

At the Mayo Clinic, where about 4000 patients a year are seen by Carman for examination of their alimentary tract by the  $\alpha$ -rays, cereal porridge is also employed for the six-hour meal and barium sulphate has been substituted for bismuth salts. Barium leaves the stomach earlier than bismuth, and, consequently, a six-hour retention of barium is considered even more significant than one of bismuth. The observations of Hayes show that purgation results in a heightening of gastro-intestinal motility for a day or two, hence no preliminary catharsis is made.

Before the patient visits the Röntgen department for examination of his alimentary tract, the following clinical test-meals are made:

At 6 P.M. on the day previous to the examination, a modified Riegel meal is given, consisting of bread, meat and potatoes. One hour later twenty raisins are taken, the skins of which are easy of identification and tend to remain in the stomach somewhat longer than the usual food material. The next morning at 8 o'clock a stomach-tube is passed. This means about fourteen to sixteen hours after ingestion of the meal. The estimate of motility is based on the presence or absence of food, pits or raisin skins from this meal. In addition to this, an Ewald test breakfast is given for chemical examination. After extraction of these test meals, the patient then goes to the Röntgen laboratory. Here he is given a meal consisting of four ounces of well-cooked wheaten breakfast cereal, with two ounces of barium sulphate, to which is added a little sugar and milk according to taste. He is then instructed to take neither food nor drink, except water, until the examination is finished. Six hours later he returns and the screen examination is begun. The presence or absence of a residue in the stomach from the motor meal is noted. If the entire meal is passed into the intestine, its position and distribution is observed and noted

<sup>1</sup> Lancet, July 24, 1915, p. 187.

on a chart. The patient is then given eight ounces of water with two ounces of barium sulphate stirred into it. Usually some of this escapes or can be driven (by palpation) through the pylorus, thus showing its amount of patency. To complete the examination and fill the stomach for röntgenography, the patient takes then about twelve ounces of potato starch pap containing approximately three ounces of barium sulphate, after which the behavior of the stomach is again observed. (Carman's technic is described below.)

Carman and Miller consider the barium carbohydrate meal as a more sensitive means for determining gastric motility than the modified Riegel meal. In addition to showing delay, the barium meal yields information as to hypermotile conditions. A distinct six-hour residue with barium (which is more easily driven out of the stomach than bismuth) indicates, nine times out of ten, the existence of some grave pathological change. The six-hour barium residue may be the most striking and definite röntgenological sign of a gastro-intestinal lesion. The other signs may be so slight and indefinite that a diagnosis might not be ventured without the presence of this retention.

THE GREAT PROGRESS MADE IN THE X-RAY DIAGNOSIS OF GASTRIC CARCINOMA. Carman<sup>1</sup> says that "95 per cent. of gastric carcinomas are discovered by this means, a percentage which is not approached by any other process of examination."

This offers a strong contrast to the clinical side of such cases as seen in the Mayo clinic, where 33 per cent. have no palpable tumors and 46.7 per cent. had no food remnants to indicate obstruction. Carman states that it is precisely in cases showing neither tumor nor food remnants that the Röntgen rays have their greatest field of diagnostic superiority. It is no longer necessary to wait until the tumor is palpable, or until evidences of marked obstruction exist. This does not mean that the clinical data should be discarded. On the contrary, the roentgenologist should be acquainted with the clinical facts. If suggestive of cancer, they will stimulate him to a more exhaustive search; if negative, they will exercise a wholesome restraint upon his interpretation of the reflex phenomena so often produced by conditions outside of the stomach.

The reviewer desires to call the reader's attention to the fact that in spite of the rather lengthy review which follows, many interesting details, of necessity, have been omitted. No one desiring to be thoroughly informed upon the present status of the subject can afford to miss reading Carman's article in the original.

<sup>1</sup> American Journal of the Medical Sciences, November, 1915, p. 625. Cole (New York Medical Journal, February 14, 1914) goes Carman one better in claiming 96 per cent. of successful diagnoses by serial röntgenography in 97 cases of various gastric lesions, subsequently confirmed by operation. The expense involved by the serial method prevents its adoption as a routine.

The röntgenological manifestations of gastric cancer enumerated in the order of their relative importance are as follows:

1. Filling defects.
2. Alterations of pyloric function; (a) gaping of the pylorus; (b) obstruction of the pylorus.
3. Perversion of peristalsis: (a) absence of peristalsis from involved area; (b) weak peristalsis; (c) antiperistalsis; (d) exaggerated peristalsis; (e) irregular peristalsis.
4. Altered motility: (a) rapid and early emptying (non-obstructive cases); (b) delayed emptying (obstructive cases).
5. Lessened flexibility.
6. Lessened mobility.
7. Diminished size (capacity).
8. Displacement.

*Filling Defects.* These were discussed at length in previous numbers of PROGRESSIVE MEDICINE of this issue. Among other points, it is remarked, that the screen examination is most essential in determining the actuality and permanence of filling defects. During this examination, the gastric shadow can be studied at various angles by turning the patient and by observing effects of active and passive movement. Such defects in the pars pylorica and pars cardiaca are more apt to be overlooked than in the pars media. A filling defect high up in the cardia may not contrast strongly with the translucent gas bubble. It is brought into better relief by pressing the barium upward with the hand in a lead-covered glove or by screening and placing in the recumbent position.

A small defect in the pars pylorica may be well seen in the partly filled stomach, but may be concealed in the distended stomach. Hence, observations before the screen should be made during the process of ingestion, as well as after repletion. The screen diaphragm should be actively employed and the aperture narrowed to increase the distinctness of small suspected areas, thus facilitating close scrutiny. Among filling defects, from causes other than cancer, are enumerated the following:

Faulty media (stiff media) poorly mixed or without sufficient barium; secretion in the stomach; food remnants; hair (trichobezoar); gas or fecal matter in the colon; barium in the bowel adjacent to the stomach; lordosis or scoliosis; pressure of the stomach against the spine; pressure of a deformed costal arch; strong retraction of the upper abdominal wall; spasm; adhesions and perigastric inflammation; extrinsic tumors including those of the liver, pancreas, kidney, large and small bowel, omentum, mesentery and belly wall; displacement and distortion of the stomach by ascites, ovarian cyst, pregnancy, etc.

A most instructive paragraph is devoted to each of the above itemized causes recounting the methods by which they may be recognized.

Particularly important are the remarks regarding the varieties of spasm, some of which are most deceptive. In a great many of these cases reexamination after the administration of an antispasmodic is necessary. A single dose of some antispasmodic drug, such as belladonna, atropin or papaverin, has been found to be unsatisfactory. At the Mayo clinic, tincture of belladonna is given in 15-minim doses t. i. d., for two or three days, or until the patient begins to show its physiological effect. (Incidentally, the patient is not told what to expect from taking the drug.) It is extremely uncommon for spasm to persist after such treatment.

Pericholecystitis with extensive adhesions about the pars pylorica accompanied as it often is by a gaping pylorus and sometimes producing a palpable mass, may be difficult to differentiate from cancer. Here only careful judgment of all the facts will prevent diagnostic errors.

*Alteration of Pyloric Function.* In cancer, the pyloric function may be perverted in either one of two opposite ways: namely, by gaping or by obstruction. The barium water often flows through a normal pylorus with little or no interruption; but as soon as the thicker pap is given, the flow usually becomes scanty or intermittent. The gaping pylorus of cancer is characterized by a free and continuous exit of both mixtures into the intestine. Very commonly the stream is voluminous, and the upper small bowel is speedily filled with the opaque mixture. The stomach may be nearly, or even completely, emptied during the brief period of examination.

Pyloric obstruction, as evidenced by a six-hour residue in the stomach, occurs in about 60 per cent. of gastric cancers, oftener than with any other lesion. The amount of residue varies with the degree of obstruction. In the majority of instances, cancers producing pyloric obstruction are of the medullary type. It is noteworthy that the lumen of the pyloric canal may be considerably diminished by the intrusion of cancer without resulting in a six-hour residue, for the reason that the lessened caliber is compensated for by the lack of sphincteric control. Since numerous causes other than cancer may operate to produce a six-hour gastric retention, the presence of a residue should not be given undue weight in making a final diagnosis, but its occurrence should stimulate a careful search for filling defects and other evidences of cancer.

*Peristalsis.* Absence of peristalsis from a cancerous area has been referred to in previous reviews. Carman notes that frequently the stomach seems to be perfectly inert. Antiperistalsis is occasionally observed in cancer with pyloric obstruction. Exaggerated peristalsis, as the sequence of cancer in this locality, is more rare than might reasonably be supposed. Hyperperistalsis is the rule with tumors at the cardia.

*Altered Motility.* Emptying of the cancerous stomach may be either retarded or accelerated, according to the presence or absence of pyloric obstruction. In the non-obstructive cases, hypermotility is the rule and is the natural sequence of the achylia and gaping pylorus. The acceleration of the gastric clearance may be extreme, and the stomach evacuated itself with extraordinary rapidity. In the obstructive cases, delayed clearance is shown by the six-hour residue. It is to be remembered that gastric motility may be affected by many things other than cancer. Hypermotility of moderate degree is a common sequence of non-obstructive duodenal ulcer, achylia and diarrheal conditions. Hypermotility, with or without a six-hour retention, may result from any sort of organic obstruction at the pylorus or just beyond it, or from reflex pyloric spasm.

The accompanying chart shows the variations in motility, according to Carman and Miller.<sup>1</sup>

Zone of hyper-motility	1 hour.	Early emptying, pathologic. (Non-obstructing gastric carcinoma. Duodenal ulcer. Diarrheic conditions.)
	2 hours.	Normal emptying. (A normal stomach functioning in a normal manner.)
	3 hours.	Early emptying, physiologic. (Hypertonic, steer-horn stomach.)
Zone of normal motility	3 hours.	Early emptying, pathologic, but slight, or partially compensated. (Duodenal irritation. Duodenal ulcer with obstruction sufficient to prolong the evacuation time to two hours in spite of associated hyperperistalsis, hypertonus and free pyloric patency.)
	4 hours.	Disordered motility with abnormal but balanced factors. (Stenosing carcinoma with achylia; average emptying time.)
	5 hours.	Delayed emptying, physiologic. (Hypotonic fish-hook stomach.)
Zone of hypomotility	5 hours.	Delayed emptying, pathologic, but slight or partially compensated. (Slight stenosis. Stenosis with hyperperistalsis; evacuation retarded but within six hours.)
	6 hours.	Delayed emptying, pathologic. Stenosis.
	7 hours.	(a) Organic. (Obstructing pyloric carcinoma. Pyloric ulcer. Obstructing duodenal ulcer. Periduodenal adhesions, etc.)
		(b) Spasmodic. (Reflex pylorospasm from ulcer on the lesser curvature, cholecystitis, appendicitis, and remote abdominal lesions.)
	8 hours.	Etc.

*Lessened Mobility.* Fixation is merely a contributory sign of cancer.

*Lessened Flexibility.* Diminished flexibility of the cancerous gastric wall is a practicable and valuable sign, especially of scirrhous cancer.

<sup>1</sup> American Journal of Röntgenology, November, 1915, p. 852.

*Diminished Size and Capacity* is a common feature of the cancerous stomach.

THE RÖNTGEN CHARACTERISTICS OF FUNGUS CANCER are given as follows:

1. A non-shrinking effect upon the stomach as a whole. While the capacity of the stomach may be somewhat lessened by the encroachment of the mass into its lumen, the gastric dimensions are not otherwise diminished. Often the hook form is preserved, and this retention of the hook form has been suggested by Handek as an indication of resectability.

2. Occasional involvement of the greater curvature, especially of the body of the stomach.

3. Sharp delimitation of the involved from the non-involved portion of the gastric wall.

4. Often large, multiple, irregular filling defect projecting into the gastric lumen and shading gradually into the central barium shadow, somewhat resembling impressions upon paraffin.

5. If located at the pyloric end, this type is likely to produce obstruction.

RÖNTGEN CHARACTERISTICS OF SCIRRHOUS CANCER. 1. Its marked shrinking effect upon the stomach. The capacity of the stomach is not merely lessened by a filling defect, but is greatly diminished by the loss of its expansibility, due to wide-spread infiltration as well as actual contraction.

2. Frequent involvement of the pyloric end and lesser curvature. Quite commonly a scirrhous completely encircles the pyloric end, and the deformity thus produced gives the stomach some resemblance to a curved funnel or an Indian pipe. The barium projects into the canalized pyloric mass as a smooth or slightly irregular spicule.

3. Gradual merging of involved into non-involved portions of the gastric wall. The limits of the lesion are difficult or impossible to determine radiologically. The lesion is usually more extensive than the picture indicates.

4. The filling defects of scirrhous cancer are commonly less grossly irregular than those of the fungous type.

5. This type of cancer, even though involving the pars pylorica, is likely to show a gaping pylorus.

Regarding carcinomatous ulcer, it is stated the only suspicious feature sometimes shown by the Röntgen rays is the extraordinarily large size of the ulcer crater.

Regarding *operability*, as determined by the Röntgen observations, it is stated that the actual extent of a medullary cancer corresponds closely to that indicated radiologically. The limits of a scirrhous cancer are much less sharply defined, and therefore a liberal allowance must be made in estimating the probable degree of involvement. In another

place, it is stated "The röntgenologist should be chary of saying that a cancer is inoperable, as he may thus deprive the patient of relief or cure at the hands of a surgeon. In the majority of instances exploration alone is the final word. The patient should be given the benefit of the doubt."

Next to the exploring finger of a trained surgeon, Röntgen rays will reveal more cancers in the early stages than any other diagnostic means. Early detection of cancer of the stomach depends upon (1) the character of the cancer, whether a frank tumor, or an insidious infiltration, or a cancerous ulcer; (2) the situation of the lesion; (3) the examiner's familiarity with the work; (4) the amount of röntgenological evidence, together with the extent of clinical corroboration.

Regarding filling defects the most important sign of all, "The test of this sign is its permanence, not its size, and we have been fortunate enough to find one which was not larger than a cherry."

In doubtful cases, reëxamination at short intervals should be made until a decision is reached.

**EARLY X-RAY SIGN OF GASTRIC CARCINOMA.** George,<sup>1</sup> of Boston, claims that there is a typical annular deformity as a result of a malignant change in a chronic gastric ulcer. This annular deformity increases the long diameter of the pyloric sphincter toward the antrum and is constant in all positions. George considers this a positive early sign of gastric cancer.<sup>2</sup> Baetjer, of Baltimore, in the discussion, also reported using atropin,  $\frac{1}{60}-\frac{1}{20}$  of a grain, two or three times a day until the patient begins to feel dry. In one or two obscure cases, this was of distinct diagnostic aid. Stewart, of New York, cited a case in which, with a typical annular deformity of the pylorus, as described by George, he insisted that a carcinoma was present and urged the operating surgeon to perform pylorectomy. This request was acceded to with some unwillingness. The specimen showed the presence of a carcinoma.

**THE EFFECT OF POSITION UPON GASTRIC MOTILITY.** Nilson and Lipsitz<sup>3</sup> found that, lying on the left side delays evacuation of the stomach more than any other position; upon the back, less so, and upon the right side, least. In other words, the stomach is emptied most rapidly by lying upon the right side. This is simply confirmation of the work of Markovic and Perussia.<sup>4</sup> Nilson and Lipsitz found that water at 45° C. leaves the stomach more rapidly than at 10° C., and that water is emptied from the stomach more rapidly during exercise than when the subject remains quiet. Furthermore, they determined

<sup>1</sup> Journal of the American Medical Association, lxxv, p. 1752.

<sup>2</sup> Carman's (of Rochester, Minn.) paper was read here. (See elsewhere for its review.)

<sup>3</sup> Journal of American Medical Association, lxiv, 1053.

<sup>4</sup> PROGRESSIVE MEDICINE, June, 1911, 60.

that normal acidity caused a more rapid emptying than artificially produced hyperacidity.

Hess<sup>1</sup> investigated the effect of posture upon gastric motility in infants and came to the same conclusions reached by other investigators referred to just above.

**The Normal Mobility of the Pylorus.** Widler,<sup>2</sup> an assistant of De Quervain, in Basle, examined the site of the pylorus in 50 healthy persons. Contrary to the general statement regarding its constant position, the pylorus was found to be extremely movable. The greatest mobility was 16 cm.; the least, 7. In a second group of 14 with ulcers of the stomach, confirmed at operation, the average mobility was 6 cm.; in 8 cases of duodenal ulcer, 5.6 cm. In a group of 29 cases of carcinoma, the greatest mobility was 8; the least, 0; the average, 4 cm.

**Gastric Ulcer.** According to W. J. Mayo,<sup>3</sup> dividing the means of diagnosis into four groups, the history is of first importance, the Röntgen ray second, the physical examination, stomach-tube findings, etc., third, and purely laboratory findings, a poor fourth.

Mayo<sup>4</sup> defends the theory that gastric ulcer is a precancerous lesion, and insists that it should be excised whenever possible. From his analysis of von Eiselsberg's statistics, it was found that 13 patients had died from carcinoma following operation for ulcer. The total number of deaths was 41. In other words, 32 per cent. of all the deaths following operation for gastric ulcer were from gastric cancer. Recent data collected by Mayo from the clinics of Payr, Perthes, and Küttner, and others, show the same result. Mayo goes on to state that opinions as to the medical cure of ulcers are based on the frequent cessation of symptoms, which, for that matter, occurs with or without treatment. When supposedly cured cases are operated upon during the quiescent interval, the ulcer is not found to be cicatrized but unhealed. The röntgenogram shows the same condition. "While no one would contend that every gastric ulcer should be surgically treated, we at least should agree that if a permanent cure does not take place within a reasonable period, other things being equal, the patient should have surgical treatment." According to Mayo, the Rodman operation is reserved for those patients in whom physical conditions are such that the operation can be safely performed, and, secondly, for those in whom the possibility of cancer amounts to a probability; so that the increased risk of the operation will be more than counterbalanced by the benefits to be derived from it.

ULCER OF THE LESSER CURVATURE<sup>5</sup> is treated by excision with the cautery, a bit of tissue being excised for microscopic examination

<sup>1</sup> American Journal of Diseases of Children, June, 1916, p. 461.

<sup>2</sup> Deutsch. Ztschr. f. Chir., Bd. 133, p. 329.

<sup>3</sup> Journal of American Medical Association, lxiv, 2036.

<sup>4</sup> Ibid., lxv, 1069.

<sup>5</sup> PROGRESSIVE MEDICINE, June, 1915, p. 91.

previous to using the cautery; afterward, gastro-enterostomy is performed. The results in blocking of the pylorus have not added anything to the value of the operation. (See also Pyloric Exclusion below.)

Transverse resections have given very good results.

ULCERS OF THE BODY OF THE STOMACH, involving the posterior wall, are at times difficult to differentiate from eroded carcinomata. Mayo states that in general, when the actual crater is larger than a silver dime, the condition is carcinomatous. For ulcers of the posterior wall, the transgastric operation is satisfactory. The anterior wall of the stomach is opened, the ulcer excised from within the stomach, and the gap sutured from within. The base of the ulcer may be pancreatic tissue; if so, it can be shaved off with a sharp knife until all the exposed part of the callus has been removed, or it may be destroyed with the actual cautery. If it is possible to gain access to the posterior wall of the stomach, a few musculoperitoneal sutures may be placed (to protect the sutures applied from within the gastric cavity) but experience has shown that these are not actually essential. The Mayos, however, took the precaution of carrying a strip of folded rubber tissue to the pancreatic lesion after covering it with omental grafts. As there was no leakage following such drainage, they are convinced that this was unnecessary. For more extensive ulcers of the posterior wall, a radical resection of the entire distal end of the stomach, including the ulcerated and contractured area, is preferable. The continuity of the alimentary tract is then re-established by anastomosing the end of the gastric pouch directly into the side of the jejunum. While comparatively few cases are sufficiently serious to warrant so extreme a procedure, nevertheless, after the failure of less radical means to give relief, especially in the presence of secondary jejunal ulcers, Mayo has adopted this plan with very satisfactory results.

Peck<sup>1</sup> reports that bleeding occurred repeatedly both before and after a von Eiselsberg pyloric exclusion for ulcer. Moreover, pain and occasional hemorrhages were still present three years later.

Peck believes it wise to do gastro-enterostomy in every case of cautery puncture, V-excision or any other direct treatment of a gastric ulcer, stating that it is quite possible that the chemical change in the gastric juice, as pointed out by Paterson, has at least some influence in favoring healing of the ulcer. In one case of ulcer close to the cardia, in which an exploratory laparotomy was done—nothing more—the pain and indigestion continued, and Peck regretted that a gastro-enterostomy was not performed in this case.

Wilson<sup>2</sup> cites two instructive cases in which lesions involving the extreme limit of the ulcer-bearing area in the stomach and duodenum

<sup>1</sup> Annals of Surgery, April, 1915, p. 406.

<sup>2</sup> Journal of American Medical Association, lxiv, 2090.

may readily escape observation even at operation. In one case, an ulcer of the duodenum was found three inches below the pylorus, and, in the other, a carcinoma of the cardia was found—both at autopsy. Both had been previously operated upon and exploration had failed to reveal the presence of these lesions.

**THE RED STIPPLING SIGN OF GASTRIC AND DUODENAL ULCER.** Scudder<sup>1</sup> says, "if the peritoneal surface over the ulcer base and its immediate vicinity is gently stroked with the rubber glove or a bit of soft gauze sponge, almost immediately there is an appearance of minute red spots distributed over the area thus traumatized (Fig. 30). This

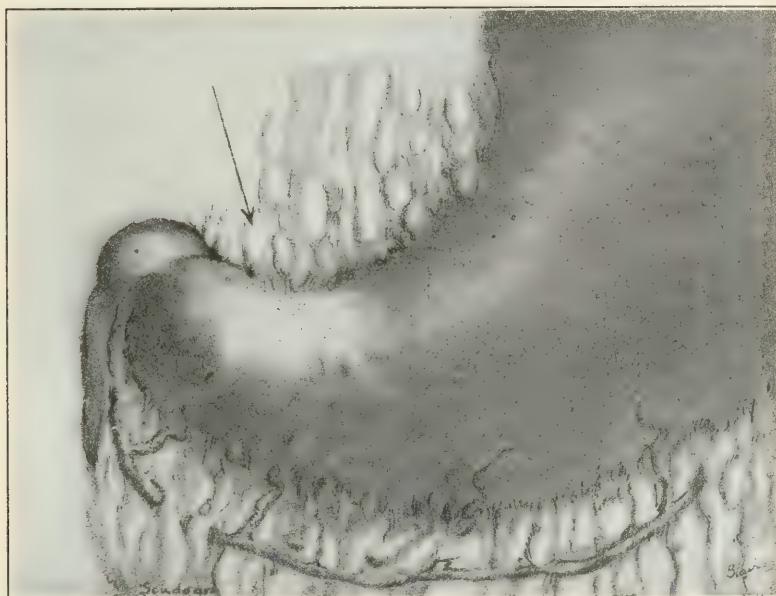


FIG. 30.—A drawing of the pyloric end of the stomach. Note the indurated white area on the lesser curvature near the pylorus and in its centre, indicated by the arrow, the fine stippling occasioned by rubbing the peritoneal surfaces with gauze. (Scudder.)

red stippling may possibly be a helpful sign in determining ulcer from cancer." Sherren<sup>2</sup> reports having recognized the importance of this sign for the past seven years. He goes on to say, "it is one of the most characteristic signs, and one on which I lay the greatest stress. It is often visible without the slightest (mechanical) stimulation, but in cases in which there is any doubt, gentle rubbing with a gauze swab will cause it to become prominent. It is particularly well marked in a chronic duodenal ulcer situated on the anterior surface of the portion, and often surrounds the ulcerated area as a ring of red speckling."

<sup>1</sup> Annals of Surgery, ix, 534.

<sup>2</sup> Ibid., March, 1915, p. 380.

**Gastrojejunal Ulcer.** Carman and Balfour add thirteen cases hitherto unpublished.

**DIAGNOSIS.** A marked deformity around the stoma was the most suggestive *x-ray* finding. "The nature of the ulcer precludes any probability of visualizing its crater as a niche, such as is often seen in penetrating gastric ulcer; in 8 of the 11 cases examined, a deformity and irregularity about the stoma indicated a pathological process in that neighborhood. According to Carman and Balfour,<sup>1</sup> the *normal x-ray findings after gastro-enterostomy* are as follows:

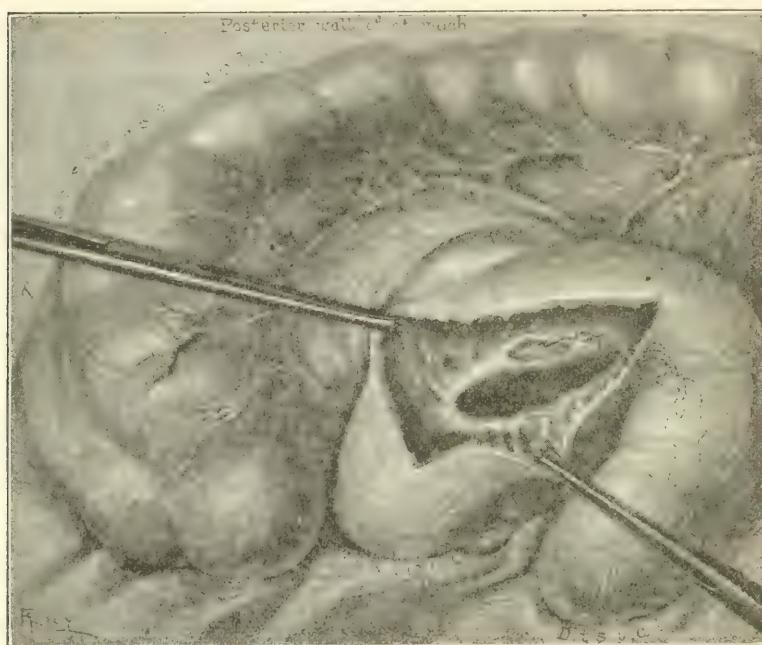


FIG. 31.—Stitch attached in gastrojejunal ulcer with end hanging in jejunum. Note the scar tissue behind the ulcer causing permanent thickening and adhesions. (Carman and Balfour.)

1. The opaque meal passes freely through the stoma. This is a rule subject to occasional exception, even after the lapse of years.
2. No retention is present in the stomach from the sixth-hour meal.
3. The duodenum is not dilated.
4. The stomach is usually small.
5. The peristalsis is not overactive.
6. The gastric contour in the vicinity of the stoma is not deformed save for an occasional slight dimpling.

<sup>1</sup> Journal of American Medical Association, lxv, 229.

7. The efferent limb of the jejunum is neither narrowed nor markedly irregular in outline.

8. Extensive adhesions about the stoma are uncommon as a simple result of operation, and the stomach is at least moderately mobile under the palpating hand.

9. The stomach is not deformed (unless by the original lesion or its resection) and has no tendency to hour-glass form or spasticity.

**Etiology.** In 6 out of the 13 cases unabsorbed, permanent suture material was found (Fig. 31). The cases of W. J. Mayo, Moynihan and Tatlow, Soresi and Berg are also quoted.

**Treatment of Gastrojejunal Ulcer.** "There is no one surgical procedure which can be adopted as a routine operative measure. The difficulties, which the individual case presents, are usually dependent on marked induration and inflammatory changes surrounding the anastomosis. In the presence of this induration and infection, plastic operations on the anastomosis, with removal of the ulcer, are associated with corresponding technical difficulties. In some cases it has been possible to excise the anastomosis, close the opening to the stomach and jejunum, and perform a pyloroplasty.

Transgastric excision has been found satisfactory in occasional instances. Usually the procedure is to expose the line of anastomosis either by a transgastric or a transjejunal incision, search for retained suture and for the ulcer, remove both, the latter either by itself, or with the entire anastomosis. If the anastomosis is constricted, and enlargement is possible, such treatment is satisfactory; if, however, much induration and infection exist, excision of the anastomosis, closure of opening, and gastro-duodenostomy are indicated.

**The Advantage of Absorbable over Non-Absorbable Suture Material for Gastric and Intestinal Anastomoses.** It has been the experience of many observers that non-absorbable sutures of silk or linen, if used upon the wall of a hollow organ (gut or bladder), ultimately find their way to its interior. In a certain definite percentage of cases, non-absorbable sutures have been found adherent to the bed of gastrojejunal ulcers, or after Finney's<sup>1</sup> pyloroplasty. Soresi describes the process leading to such a condition in a most plausible manner. He says, "Some stitches will go through the tissues a little more deeply than others, with the result that when sloughing of the tissues encircled by the suture begins, the suture becomes loose and the tissues engaged by the more superficial stitches will be eliminated first. This allows the thread to become loosened, the deeper stitches fail to cut through, regeneration takes place around the thread, which is thus held indefinitely in place, hanging from one or more points in the stomach or intestinal cavity. The point of emergence of the thread will facilitate

<sup>1</sup> American Journal of the Medical Sciences, October, 1915, p. 473.

the infection of the mucosa and its attack by acids of the stomach." Soresi therefore advocates using plain iodized or chromic catgut for the through-and-through internal sutures and believes that silk or linen can be safely used for the serous layer.

During a recent visit to the Mayo clinic, the reviewer learned that since January 1, 1914, Dr. C. H. Mayo had been using catgut both for the inner and outer layers of his gastro-enterostomies. At the Mayo clinic it was found that the use of catgut for the inner layer and of a row of interrupted silk sutures for the seroserosa did not prevent the formation of gastrojejunal ulcers in a small but definite percentage of cases, and that, in the base of such ulcers, one or more interrupted sutures used for union of the serous coat were found adherent.

**Pyloric Exclusion.** RECENT MODIFICATIONS. Lewisohn's monograph<sup>1</sup> reviews all the previously existing methods and contains his own modification of the Biondi operation. As will be remembered, Biondi makes a longitudinal incision across the pylorus down to the mucosa. The mucosa is then peeled away from the muscularis and is cut between ligatures. The stumps are carbolized, and the seromuscular coat is then closed with a few sutures. Instead of this, Lewisohn frees the stomach near the pylorus and then makes a circular incision down to the mucosa. By blunt dissection, a tube of mucosa about one inch in length is developed. This tube is divided between ligatures and the stumps carbolized. The stomach near the pylorus is thus divided in a perfectly aseptic manner. The proximal and distal stumps are now closed by an invaginating stitch over the ligated mucosal stumps.

Lewisohn agrees with Leriche that, with the exception of von Eiselsberg's, none of the exclusion methods guarantee a permanent occlusion of the pylorus. In this connection, Lewisohn demonstrated a resected pylorus upon which a ligature occlusion had been performed two years before. The pylorus was patent, admitting the little finger. On the anterior surface the Pagenstecher stitch was still in its subperitoneal position. The knot was distinctly visible and intact. In another specimen (private communication) the stitch had cut through the posterior coat, and its posterior half was free within the mucosa.

Randisi<sup>2</sup> advocates the method of Parlavecchio using a tape 15 mm. wide, whose ends are sutured, not knotted.

Gibson and Beekman<sup>3</sup> report one case with a fascial strip (according to Wilms) in a man with satisfactory results six months after operation. Two other patients were lost tract of. Their experimental work on dogs accord with the general experimental findings of others. In the discussion which followed, Brewer said that he firmly believed that pyloric exclusion was only indicated in a comparatively small

<sup>1</sup> Surgery, Gynecology and Obstetrics, April, 1916, xxii.

<sup>2</sup> Clin. Chir., 1915, 23, H. 2.

<sup>3</sup> Annals of Surgery, April, 1915, p. 423.

number of cases, and, in his own experience, particularly with duodenal ulcers, simple gastro-enterostomy had given very satisfactory results. He could not at the moment recall a single case in which exclusion of the pylorus would have been of any advantage.

H. H. M. Lyle<sup>1</sup> referred to certain *x-ray* plates of the stomach after the von Eiselsberg operation, showed by Kammerer at a previous meeting of the New York Surgical Society. In these plates the lower angle of the stomach had tilted downward and formed a pouch whose level was below the gastro-enterostomy opening. Recently, such a case had come to St. Luke's Hospital with the diagnosis of ventral hernia. In repairing the hernia, an examination of the stomach revealed a condition such as described by Kammerer. The gastrohepatic ligament was shortened, and the angle of the stomach restored to its normal level (demonstrated by *x-ray* examination). The restoration of the level gave clinical relief. Lyle mentioned this to call attention to the necessity of providing against sagging of the pyloric end of the stomach.

Kammerer<sup>2</sup> reported 8 cases operated by the von Eiselsberg method, with no mortality.

The statement that a gastro-enterostomy opening would close in time if the pylorus remains patent is not borne out by the observations of Peck,<sup>3</sup> who examined a number of patients more than four years after gastro-enterostomy and found that the majority of the gastro-enterostomy openings were functioning in spite of a pylorus known to be patent and not occluded at the time of operation.

Peck quotes Küttner's conclusions from a study of 1,100 cases of surgical conditions of the stomach and duodenum. Küttner also believes that gastro-enterostomy functionates in the presence of an open pylorus. Re-examination of patients long after the operation had been performed caused Küttner to doubt whether artificial constriction of the pylorus actually gave better results than simple gastro-enterostomy. Kocher and Sherren both advise against pyloric exclusion, seeing no advantage in it. In addition to this, Peck quoted the statement that von Eiselsberg's own series of 36 cases showed no better results than simple gastrostomy.

According to W. J. Mayo,<sup>4</sup> pyloric exclusion is not indicated unless there are symptoms of impending perforation or hemorrhage. Gastro-enterostomy is the operation of choice. In gastric ulcer to this is added resection or incision—removal, in short, of the gastric ulcer whenever this is possible. In duodenal ulcer, a simple infolding of the ulcer is made. Occasionally, excision, combined with a Finney pyloroplasty, may be used in suitable cases.

<sup>1</sup> Annals of Surgery, April, 1915, p. 490.

<sup>2</sup> Ibid., p. 491.

<sup>3</sup> Journal of American Medical Association, lxv, 659.

<sup>4</sup> Ibid., lxiv, 2036.

The so-called recurrences of duodenal ulcer after operation in the majority of cases are due to improper technic, especially as a consequence from using continuous, non-absorbable sutures of silk or linen which have been found to cause gastrojejunal ulcer.

In cutting off more than 100 gastro-enterostomies which had been made for symptomatic ulcer at the Mayo Clinic, no evidence was found of gastric or duodenal ulcer. (Symptomatic ulcer meaning one which could not be demonstrated by gross inspection.) Blocking the pylorus will not help to cure these patients who have been unnecessarily operated on. The scar left from the blocking introduces cicatricial changes which may be mistaken for the scar of a former ulcer.

Elsewhere Mayo<sup>1</sup> says: "The necessity of this procedure is not clear. We have not found that the patients in whom the pylorus was blocked have in any way had results superior to those in whom it was not blocked following simple gastro-enterostomy." . . . "There is no evidence that the routine blockage of the pylorus is advisable or necessary." However, as said above, if perforation is impending, Mayo deems it wise to block the pylorus and cover the ulcer. Likewise, if there have been hemorrhages, this should be done and the vessels in the vicinity of the ulcer carefully tied.

**Spontaneous Pyloric Occlusion.** The following case is reported by Wendt.<sup>2</sup> A man, aged thirty-two years, was operated upon a year and a half previously for ulcer of the duodenum. Gastro-enterostomy; no pyloric exclusion. The symptoms recurred within a few months. A second laparotomy showed that the ulcer of the duodenum had entirely healed so that a strand of connective tissue, from 2 to 3 cm. long, connected the oral with the aboral part of the duodenum. There was a large callus ulcer at the gastro-enterostomy stoma which almost occluded it. Anterior gastro-enterostomy was performed. This shortly gave rise to a second gastrojejunal ulcer followed by persistent vomiting which did not improve after jejunostomy. The autopsy showed no peritonitis. The case is remarkable for the total obliteration of the duodenum at the site of operation.

**Hypertrophy of the Pylorus Diminished after Gastro-enterostomy.** In a study upon the musculature of the pylorus (in fifteen specimens resected for ulcer) Truesdale<sup>3</sup> reports that there is a distinct overgrowth of musculature in the presence of gastroduodenal ulcer, whereas after gastro-enterostomy, with a stoma which functionates well, the pyloric sphincter and adjacent muscular wall becomes atrophied and atonic. In elaborating on these theories Truesdale suggests that patients who have acquired the greatest degree of muscular hypertrophy at the pylorus obtain the most lasting benefit from gastrojejunostomy. Again,

<sup>1</sup> Journal of American Medical Association, lxiv, 2040.

<sup>2</sup> Bruns's Beitr., Bd. 95, f. 2, p. 282; Zentralbl., 314.

<sup>3</sup> Surgery, Gynecology and Obstetrics, September, 1915, p. 298.

that when the pyloric sphincter is found hypertrophied and no gastro-duodenal lesions exist, the gall-bladder and appendix should be examined, since pathological changes in them may account for a spasm of recent origin. Truesdale's statement that the presence of a gastro-enterostomy inhibits the function of the pylorus and leads to the

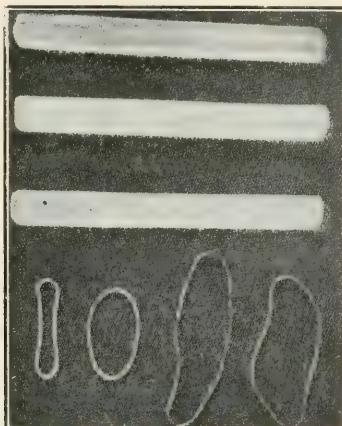


FIG. 32.—Elements used in tongue depressor clamp. (Gibson.)



FIG. 33.—Clamp applied to intestine. (Gibson.)



FIG. 34.—Both loops clamped and clamps approximated and held by rubber bands. (Gibson.)

atrophy of its musculature cannot be accepted as proven. The röntgenologists tell us that, in the presence of a patent pylorus and a patent stoma, the food leaks through the stoma and is passed through the pylorus by the peristaltic waves which continue as usual along the stomach from above downward. In other words, the presence of a gastro-enterostomy does not inhibit the function of the pylorus. Next,

it is difficult to understand how Truesdale reconciles with his own theory the findings of Scudder, who showed that pyloric tumor in infants does not disappear after gastro-enterostomy. The atrophied atonic pylorus found at a second laparotomy two years after gastro-enterostomy by Truesdale may have its development explained in other ways. For example, a submucous and interstitial deposit of fibrous tissue, with subsequent cicatricial contraction or chronic inflammatory changes may have led to considerable degeneration and atrophy of the muscular and fibrous coats, leading to subsequent atonic dilatation of the pylorus.

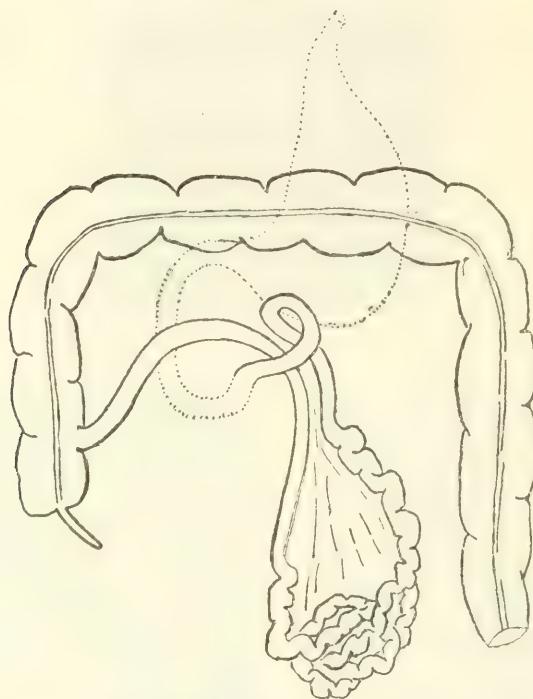


FIG. 35.—Diagrammatic illustration of intestinal obstruction found at secondary operation. (Moschcowitz and Wilensky.)

Truesdale's suggestion that hypertrophy of the musculature follows long-standing spasm seems much more plausible than his atrophic theory. In the discussion which followed, Fred Murphy, of St. Louis, emphasized that the results of gastro-enterostomy without obstruction of the pylorus are at least uncertain. Murphy cited 12 cases with resection for ulcer, with satisfactory late results.

**Gibson's Tongue Depressor Gastro-enterostomy Clamp<sup>1</sup>** was referred to last year.<sup>2</sup> The accompanying illustrations show this evidently simple means (Figs. 32, 33 and 34).

<sup>1</sup> Ann. Surg., May, 1915, p. 604.

<sup>2</sup> PROGRESSIVE MEDICINE, June, 1915, p. 75.

**Intestinal Obstruction following Posterior Retrocolic Gastro-enterostomy**  
Moschcowitz and Wilensky<sup>1</sup> have collected 7 cases from the literature to which they have added 1 of their own. When the gastro-enterostomy is completed, an artificial foramen is formed by the afferent loop of jejunum which is attached at the duodenojejunal junction and at the stoma. In other words, the no-loop posterior gastro-enterostomy is rather a short-loop, gastro-enterostomy. Through this foramen the

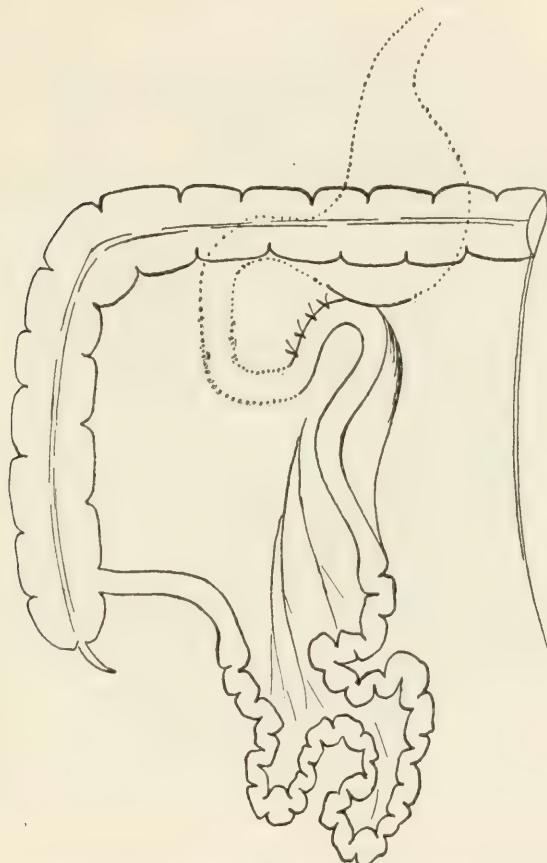


FIG. 36.—Diagrammatic illustration of obliteration of foramen formed in the course of gastro-enterostomy. (Moschcowitz and Wilensky.)

small intestine had worked its way, as seen in Fig. 35. Moschcowitz and Wilensky<sup>2</sup> advise obliteration of this foramen by suture of the afferent loop of jejunum to the inferior leaf of the transverse mesocolon (Fig. 36), with three or four sutures of Pagenstecher thread, thus converting the short-loop operation into a no-loop operation.

<sup>1</sup> Surgery, Gynecology and Obstetrics, September, 1915, p. 390.

<sup>2</sup> Ibid.

They add that such an anchoring may aid in the prevention of the formation of a vicious circle.

**Periduodenitis.** Oppel<sup>1</sup> refers to 3 cases previously operated upon and gives the details of a fourth. Previous to having been seen by him, the patient had two other operations, one, appendectomy, and the second, cholecystectomy. She still complained of an intense pain in the right hypochondrium. Upon opening the abdomen, he found a periduodenitis. Dividing the adhesions, he covered the denuded areas with flaps of omentum, and the patient made a complete recovery with entire relief.

**Retroperitoneal Perforation of Duodenal Ulcer**, while a rare complication, has been observed to occur with perforations of the ulcers on the posterior wall of the second part of the duodenum. Petrén<sup>2</sup> also mentions perforations in the third part of the duodenum, an extremely rare occurrence. Petrén cites the case of Warvinge and Wallace, in 1884, in which a chronic progressive perforation led to the development of a small limited retroperitoneal abscess and to a direct breaking into the superior mesenteric vein with subsequent thrombosis of the portal vein and suppurative hepatitis. Naturally, such retroperitoneal suppuration has to be differentiated from that caused by an acute appendicitis, a perinephritic abscess or disease of the pancreas, liver or bile ducts. Petrén refers to unilateral exclusion of the pylorus for duodenal fistula, as advocated by Berg in 1903.

**Rupture of the Duodenum.** (See PROGRESSIVE MEDICINE, last year.) Two cases are reported by Niederle.<sup>3</sup> Trauma from an iron rod caused the damage in one case and the kick of a horse in the other. In the first case there was a retroperitoneal tear of the duodenum 4.5 cm. long at the junction of the descending and horizontal portions. This was sutured and a posterior gastro-enterostomy was performed, followed by drainage. The patient recovered. In the second case, two-thirds of the periphery of the intestine were cut across at the junction of the descending with the horizontal section. Closure with two rows of suture, posterior enterostomy and drainage of the injured site. A duodenal fistula developed later on and death followed. Autopsy showed the entire suture line had reopened.

**Pyloric Obstruction in Infants.** Downes<sup>4</sup> reports 66 cases in which operation was performed during the past five and a half years. Of these 31 were gastro-enterostomies, and 35 were the Rammstedt operation. Gastro-enterostomy gave a mortality of 35 per cent., the Rammstedt operation, 33 per cent. In no case has there been a return of the symptoms.

<sup>1</sup> Journal of Surgery, January, 1915, p. 416.

<sup>2</sup> Annals of Surgery, April, 1915, p. 414.

<sup>3</sup> Zentralbl. f. Chir., 1915, 380, pp. 125 and 126.

<sup>4</sup> Journal of American Medical Association, lxvi, 216.

Strauss<sup>1</sup> performs pyloroplasty by cutting down to the mucosa and shelling it out. He reduces the folds of the infolded mucous membrane (Fig. 37), then reconstructs the hypertrophied musculature to its normal thickness by cutting away either the inner circular layer or using it as a plastic flap. The muscularis was everted as much as possible, and, with a fine scalpel, the muscle tumor was divided longitudinally and in two layers of equal thickness, a deep and a superficial.

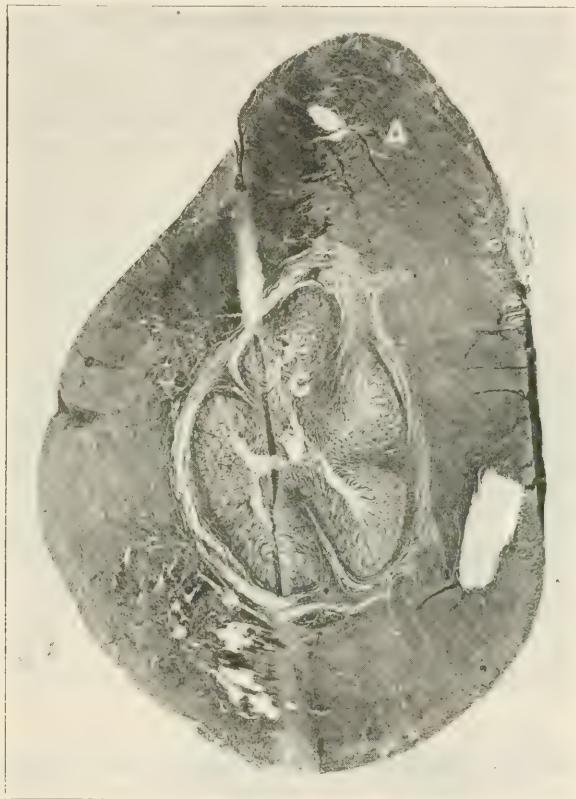


FIG. 37.—Photomicrograph: *A*, hypertrophied muscle; *C*, infolded membrane.  
(Strauss.)

The newly made flap was everted (Fig. 38). The opposite side was then treated in the same way. The everted edges were closed over and a small piece of free transplant from the great omentum was sutured over the pylorus to cover the raw surfaces. The entire operation did not take ten minutes. This seems to be an unnecessary complication of the original Rammstedt's method.

<sup>1</sup> Journal of American Medical Association, lxxv, 1533.

**Syphilis of the Stomach** is a much more frequent condition than has been hitherto supposed. Last year, Downes and Lewald<sup>1</sup> reported a series of 8 cases, and more recently Smithies<sup>2</sup> reports a series of 26 cases, representing 1.6 per cent. of 1603 demonstrable stomach lesions. The Wassermann reaction was positive in all of these. In 7 explorations, ulcers or nodules were found in 6. Administration of salvarsan and mercury gave satisfactory results. The prognosis is doubtful. Only 4 of the series were free from symptoms for a year; 3 were not benefited at all, and 12 showed merely some amelioration of their symptoms.

Mühlmann,<sup>3</sup> in discussing diffuse syphilitic involvement of the stomach, states that within a year after the symptoms of dyspepsia come on, there are unmistakable signs of a small, shrivelled stomach. The capacity is reduced to one glass (or 0.5 liter) of fluid. Everything

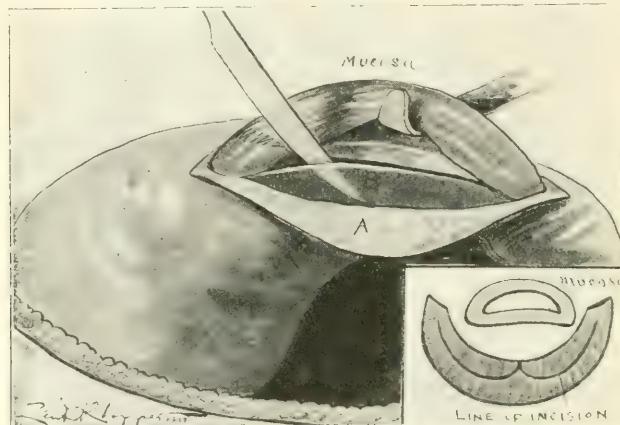


FIG. 38.—*A*, muscle tumor; *B*, internal layer of muscle; inset, transverse sections. (Strauss.)

over this amount is vomited, while the patients themselves are ravenously hungry all the time. This symptom plus the lack of cachexia, excludes cancer.

The following **pathological curiosities** have been published during the past year:

A GASTRIC CANCER IN A BOY OF NINE is reported by Karl.<sup>4</sup> The tumor was as large as a child's fist and was situated at the pyloric region. Resection of the stomach, with implantation into the jejunum was performed. Three months after operation,<sup>5</sup> the patient was in good condition.

<sup>1</sup> Journal of American Medical Association, 1915, lxiv, 1824. <sup>2</sup> Ibid., lxv, 572.

<sup>3</sup> Deutsch. med. Wchnschr., June 17, 1915.

<sup>4</sup> Ibid., March, 1915.

<sup>5</sup> Journal of American Medical Association, lxiv, 1621.

De Jong<sup>1</sup> reports a series of FOUR CASES OF BENIGN TUMOR NEAR THE PYLORUS. In 3, the normal glands near the pylorus had proliferated, narrowing the lumen. In the fourth case, a small mass of aberrant pancreatic tissue formed an obstruction. In the first case there was a history of long-standing stomach trouble. At operation, a ring of enlarged Brunner's glands was found obstructing the pylorus. Resection and gastro-enterostomy was followed by complete recovery. In the second case the enlarged glands formed a single tumor at the duodenum. The patient, a boy, aged twelve years, died of sarcoma of the tibia, but, shortly before death, complained of severe abdominal pains caused by perforation of the ulcerated and enlarged glands as proved at autopsy. The third case was a man, aged twenty-eight years, who died from perforation of multiple ulcers, two in the stomach and two in



FIG. 39.—Hemangio-endothelio-blastoma associated with gastric ulcer. (Sherrill and Graves.)

the duodenum. One of the former was situated in the enlarged mass of glands. In all of these 3 cases the glandular tissue was histologically normal. In the last case a small mass about the size of a pea, having a broad base in the mucosa, was removed from the stomach near the pylorus. Microscopic examination proved it to be normal pancreatic tissue.

**HEMANGIOMA OF THE STOMACH.** Sherrill and Graves<sup>2</sup> reported a case of this condition with unusual symptoms. A woman, aged thirty-one years, had struck her epigastrium against the corner of a table. Soon after this she began to have disturbance of gastric function, combined with marked anemia. Upon examination, a mass was made out in the

<sup>1</sup> Journal of American Medical Association, lxvi, 392.

<sup>2</sup> Surgery, Gynecology and Obstetrics, April, 1915, p. 443.

epigastrium. At that time a diagnosis of gastric ulcer was made. Five years later the mass was found to be the size of a kidney and had a wide range of mobility. The gastric symptoms persisted. The diagnosis lay between ulcer forming a tumor or perhaps gastric ulcer combined with the presence of a floating kidney.

At laparotomy, a reniform mass, growing from the greater curvature near the pylorus, was discovered (Fig. 39). An enlarged gland was found in the omentum near the base of this mass. A complete transverse resection of the affected portion of the stomach was made, combined with gastro-enterostomy.

The specimen showed three small openings in the mucous membrane, one of which extended entirely through the gastric wall and communicated directly with the interior of the tumor. Through this opening the little finger could be readily passed. Microscopic examination revealed the tumor to be a hemangio-endothelioblastoma.

**Visible Acute Dilatation of the Stomach during Laparotomy** was discussed last year. Since then two cases have been reported by Luckett.<sup>1</sup> As said before in regard to this subject, one cannot get away from the idea that ether was swallowed and became vaporized in the stomach. Aerophagy could never give so rapid a dilatation. Passage of the stomach-tube has always relieved the condition which did not recur.

### THE SMALL INTESTINE.

**Typhoid Perforation.** Gibbon recounts a series of 112 patients operated upon between 1901 to 1915 by the various surgeons of the Pennsylvania Hospital. There were 27 recoveries (24.1 per cent.). To show how valueless a small collection of cases is in determining the mortality of a given operation, Gibbon cites the fact that between 1909 and 1914 there were 15 operations, with no recoveries, but in the past year there were 10 operations with 5 recoveries. A careful review of the case histories fails to show a greater severity of the disease in one series than in another, nor was there anything else in the patients' condition which would account for the great difference in the mortality rate *except the time between perforation and operation.* "Delay after symptoms of perforation is fatal, every hour is valuable, and one must not wait until he is sure that a perforation has occurred before operating. It is better to make a mistake in a few cases of operating when no perforation is present, than to delay operation until a diagnosis is certain. The most common cause of delay is in obtaining the permission for operation from the patient or his relatives. To prevent this, it is wise to obtain a conditional consent in every case of typhoid fever."

In discussing diagnosis, he remarked that the two most valuable

<sup>1</sup> Journal of American Medical Association, 1915, lxiv, 2055.

symptoms are pain and rigidity. Again, the less sudden and less severe the pain and rigidity, the more difficult the diagnosis becomes. Digital examination by rectum should always be made and often will reveal acute tenderness, which is of great significance.

"We are convinced that the absence of a leukocytosis is of no diagnostic value. As a rule it takes from eight to twelve hours for the average case of perforation to develop a leukocytosis."

"Delay is the cause of high mortality (see above). On the other hand, it has not been our experience that a quick exploration does much harm even when no perforation is present. Infiltration anesthesia, preceded by morphine and atropin, certainly offers the safest means of confirming the diagnosis, and, in the majority of instances, is quite sufficient for the entire operation."

The frequent development of lung complications after these operations convinced Gibbon that ether anesthesia increases the hazard. Many such cases are lost because the patients are completely anesthetized (often with ether) long before the surgeon is ready to begin the operation.

As said above, Gibbon advises opening the abdomen under infiltration anesthesia and gives a general anesthetic only if necessary, and that for as brief a time as possible. As to the actual operative procedure, he quotes the series of 38 cases operated upon by Hays, of Pittsburgh, with a recovery rate of 36 per cent. Hays advocates enterostomy, suturing the perforated bowel into the wound and allowing it to drain.

**Angioma of Duodenojejunal Junction and Upper Jejunum.** An example of this extremely rare condition is reported by Beer.<sup>1</sup> The chief symptoms were digestive disturbances and vomiting of blood, as well as the appearance of blood in the stools. At operation, the small intestine appeared normal up to within six inches of the fossa of Treitz, where the jejunum suddenly became red in color due to the injection of a large number of minute vessels. After separating adhesions which bound this part of the jejunum to the transverse mesocolon, the entire surface of the upper three or four inches of jejunum was found covered with dilated vessels, many of which were fully one-eighth to one-tenth of an inch in diameter and projected over the level of the adjacent jejunal wall (Fig. 40). As this vascular tumor involved the duodeno-jejunal junction, a resection was impossible. Ligature of the vessels was impracticable and therefore it was determined to exclude the tumor-bearing area and perform a duodenojejunal anastomosis between the third part of the duodenum and the jejunum (Fig. 40). The peritoneum over the third part of the duodenum was cut through, and a circular exclusion silk ligature was passed around it, after pushing the pancreas out of the way. The furrow made by tying this ligature loosely

<sup>1</sup> Surgery, Gynecology and Obstetrics, October, 1915, p. 519.

was buried by two layers of sutures, the second layer bringing the cut posterior parietal peritoneum into approximation with the first layer of suture. A typical clamp suture anastomosis was then performed, every advantage being taken to use the jejunal serosa to cement the union, as the duodenum had no peritoneal covering. The patient did fairly well until the sixteenth day when there was a sudden change,

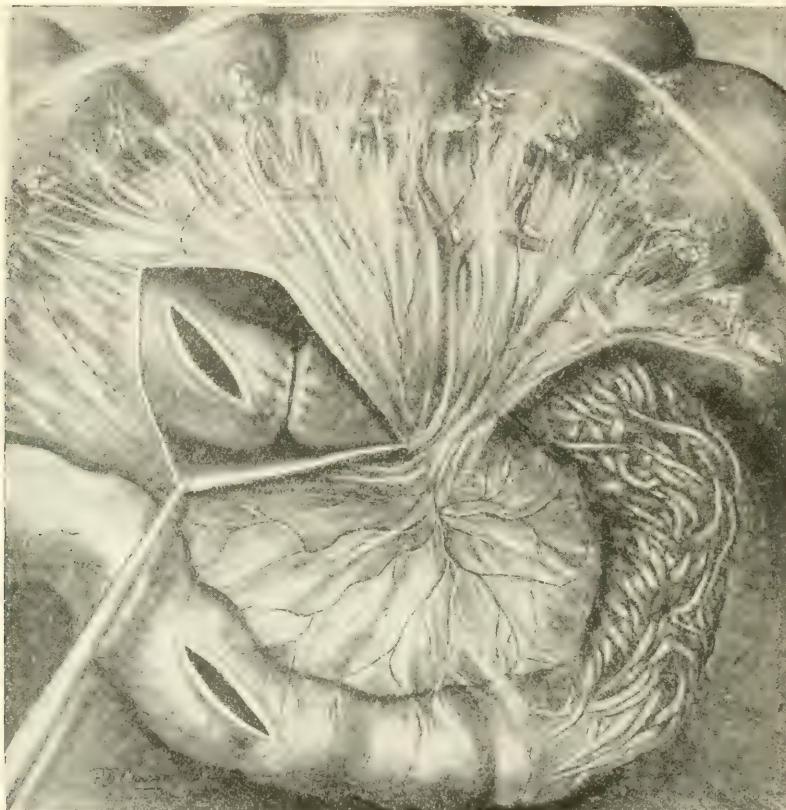


FIG. 40.—Shows incision in posterior parietal peritoneum held open exposing duodenum, its stoma, and excluding ligature. To the other side of the mesocolon is the vascular tumor, looking like an enormous conglomeration of vessels involving the upper three or four inches of jejunum. (Beer.)

with recurrence of hemorrhage from which she died within twenty-four hours.

**Angioneurotic Edema as a Cause of Intestinal Obstruction.** When Bogart<sup>1</sup> opened the abdomen, a considerable quantity of blood-stained fluid escaped. The lower ileum was somewhat distended and congested,

<sup>1</sup> *Annals of Surgery*, March, 1915, p. 324.

with a few ecchymotic spots. Upon following the intestine upward from the ileocecal valve, it was normal in appearance until the jejunum was reached, which was found swollen and edematous. This extended up to the duodenojejunal junction and was so pronounced as to produce a stiffening of the intestine sufficient to prevent peristalsis. When grasped between the forefinger and thumb, the intestine was apparently one inch in thickness. Evidently the lumen of the bowel was almost, if not completely, obliterated by this swelling. The abdomen was closed, and under frequent gastric lavage and enemata, the patient was kept comfortable until the condition subsided after several days. Then a diarrhea developed, with passage of blood in small amounts. The patient was discharged at the end of seventeen days. Ten days after leaving the hospital there developed edema of both feet, one hand, and the left side of the chest. In the absence of temperature and in the presence of this transient cutaneous edema, Bogart felt justified in considering the case one of intestinal angioneurotic edema.

Osler's remarks upon affection of the gastro-intestinal tract in angioneurotic edema are quoted, among others the following points are of interest: That the colic, which is a common abdominal symptom, may simulate appendicitis, gall-stone colic or renal colic, or even perforation of a gastric or duodenal ulcer. The passage of blood in children may suggest intussusception.

**Gastric Glands in Meckel's Diverticulum.** At autopsy upon a nineteen-month-old child dying from intestinal hemorrhage, a Meckel's diverticulum was found, at the base of which the mucous membrane of the ileum showed an ulcer, with erosion of an artery. The adjacent mucous membrane of the diverticulum showed the histological structure typical of the gastric mucous membrane in the region of the fundus.

**Localized Arteriosclerosis of the Intestinal Vessels.** At autopsy upon a patient dying from mesenteric thrombosis, Hedlund<sup>1</sup> found moderate arteriosclerosis of the aorta and large mesenteric vessels. In contrast to this, there was a most extreme grade of arteriosclerosis leading to obliteration of the vessels in the subserosa of the intestinal wall, and especially of the lower part of the small intestine and of the entire large intestine. This was accompanied by a thickening of the subserosa, muscularis, and submucosa, with deposit of much connective tissue. Similar cases were reported by Oertner in 1903, and Warburg in 1905.

In Oertner's case there were also marked arteriosclerotic change in the heart and great vessels.

A most remarkable case of arrested development of the small bowel in a man, aged twenty-eight years, is reported by Sir Alexander McCormick.<sup>2</sup>

<sup>1</sup> Hygiea, 1915, Bd. lxxvii, 9.

<sup>2</sup> British Journal of Surgery, April, 1915, p. 710.

The chief complaint was attacks of vomiting without much nausea. Clinically, a greatly dilated stomach was made out. Upon opening the abdomen, the findings were as follows:

"The stomach was found to fill up the entire abdominal cavity, extending right down into the pelvis, and was with great difficulty delivered through the wound (Fig. 41). All the vessels were enlarged, and the wall hypertrophied. The jejunum and ileum were entirely absent except for six inches, without mesentery, half the circumference being covered by peritoneum, corrugated as though containing valvulae

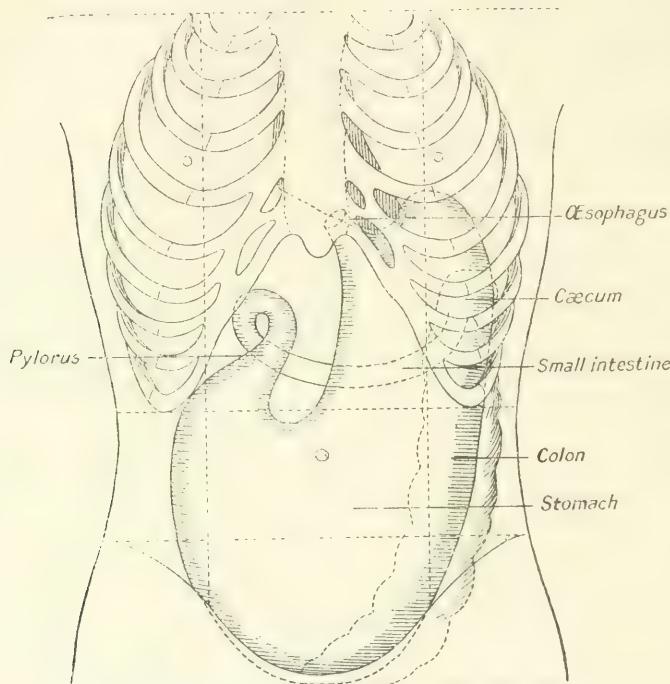


FIG. 41.—Diagram of case of arrested development and an almost entire absence of small intestine. (MacCormick.)

conniventes; just beyond the duodenojejunal flexure, which was placed higher than usual, this went straight into what appeared to be the ceceum, in the splenic region. The ascending and transverse colons were absent. The wall of the descending colon was very atrophied. No vermicular appendix was noted. There was no pyloric thickening, and the duodenum seemed to go straight across the vertebral column. The liver and gall-bladder were in their normal positions, and a finger was inserted through the foramen of Winslow. The opening of the biliary duct into the alimentary canal was not seen. The pancreas was unobserved, but was not searched for. The whole abdominal cavity

was explored with the hand and by observation. A stomach-tube was passed with the wound still open, and some dirty, offensive fluid was syphoned off, mixed with undigested food. The stomach thereupon became slightly smaller. No interference being indicated, the incision was sutured."

The patient made an uninterrupted recovery.

"I have failed to find any description of a similar condition in the literature; but, in a private letter from Professor Keith,<sup>1</sup> he draws my attention to a case in St. Bartholomew's Hospital, London, of a boy aged twelve years, in whom the small intestine was only two feet in length. This was a specimen obtained by Mr. Abernethy. The colon in this case measured four feet."

It was presumed that the stomach was serving the chief purposes of digestion and absorption. The patient was fairly well nourished.

A somewhat similar anomaly of the alimentary tract is cited by Ragnvald Ingebrigsten.<sup>2</sup> Namely:

**Incomplete Rotation of Colon: Cecum Mobile; Ileus.** Autopsy upon a sixteen-year-old patient who, previous to the illness which caused his death, never had any symptoms, revealed the following conditions: The stomach and upper duodenum were normal. The lower duodenum had a mesentery 5 cm. long between the leaves of which lay the pancreas. There was no duodenojejunal angle. There was hyperplasia of the entire small intestine, which was only 4 metres long, ending in a very small colon of 70 cm. in length. The ileocecal region had a mesentery 5 to 6 cm. long, which was directly continuous with the mesentery of the duodenum and small intestine. The ascending colon, which lay properly retroperitoneal, went directly to the splenic flexure. The sagittally situated duodenum, with its mesentery, obstructed the colon and produced the ileus which had caused death.

**Viability of a Portion of the Small Intestine Freed from its Mesentery for a distance of 7 cm.**

Bastinelli<sup>3</sup> performed laparotomy upon a man aged twenty-six years for what was apparently an acute appendicitis. Operation revealed the presence of hemorrhage from a trauma which the patient had previously refused to acknowledge—contusion from the steering handle of a bicycle. There was a rupture of the mesocolon, with secondary infiltration of the cecum and ascending colon. The colica media and the ileocecal vessels were tied; resection of cecum and ascending colon on account of the danger of gangrene. In order to effect a terminal-lateral anastomosis between the small intestine and transverse colon, it was necessary to mobilize 7 cm. of the small intestine from its mesentery to avoid undue

<sup>1</sup> St. Bartholomew's Hospital, Catalogue of the Anatomical and Pathological Museum, 1884, ii, 40. (Case No. 3634.)

<sup>2</sup> Norsk Magazin for Laegevidenskaben, 1914, Jahrg. 75, Heft 5.

<sup>3</sup> Policlinico, 1915.

tension. The cecal end of the transverse colon was used to establish a temporary fecal fistula in the angle of the wound. The patient



FIG. 42.—Schematic view of reconstruction of pylorus; *a*, anastomosis showing where graft is obtained; *b*, graft secured in place with a seroserosus suture; *c*, incision of pylorus. (Soresi.)



FIG. 43.—Schematic view of reconstruction of the common duct; *a*, anastomosis; *b*, grafting in place attached to its mesentery. This illustration shows the stump of the duct entering the duodenum as being within the lumen of the grafting; this is to be interpreted as a schematic view of the procedure; in fact, the stump is not put within the lumen of the grafting, the implantation of which in the duodenum takes place at some distance from the entrance of the common duct into the same. (Soresi.)

recovered. This survival of the small intestine deprived of its mesentery substantiated the experiments of Colmheim, Chiarelli and others.

**Intestinal Grafts in the Reconstruction and Repair of Abdominal Organs** was made the subject of experimental studies by Soresi.<sup>1</sup> This author is correct in his assumption that a graft is most effective when its normal blood supply is maintained.

In spite of his 18 successful experiments in reconstruction of the pylorus (see Fig. 42), one does not entirely agree with Soresi in his statement "that this method will completely supersede gastro-enterostomy or pyloromyotomy in benign stenosis of the pylorus, and might be used in gastric and duodenal ulcers instead of gastro-enterostomy," for the reason that the resection of a piece of small intestine, followed by entero-anastomosis, is a major undertaking. To this must be added the subsequent patching of the stomach or duodenum. It will certainly require considerable clinical proof before such a procedure will supplant Finney's pyloroplasty or the usual gastro-enterostomy.

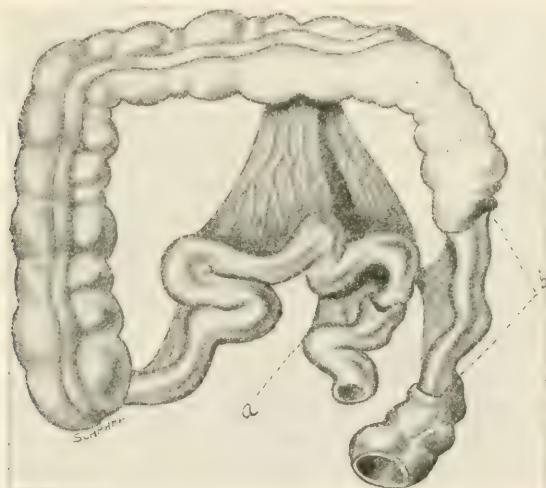


FIG. 44.—Schematic view of reestablishing the continuity of the colon; *a*, anastomosis of small intestine where graft is obtained; *b*, piece of small intestine grafted in the colon. (Soresi.)

Likewise, Soresi's method for patching defects of stomach and intestine, while mechanically sound, will have a limited application, because of the time necessary to obtain the graft and reestablish the intestinal lumen.

Soresi's reconstruction of the common bile duct (Fig. 43) with a piece of small intestine is very similar to that suggested by Montrofit.<sup>2</sup> Nor can the statement be accepted that "The means which have hitherto

<sup>1</sup> Surgery, Gynecology and Obstetrics, June, 1915, p. 668.

<sup>2</sup> PROGRESSIVE MEDICINE, June, 1910.

been suggested to reconstruct the duct have all met with failure." The only other method of establishing the biliary flow mentioned by Soresi is cholecystenterostomy. (Compare this paucity of references with Walton's article on the same subject, see Liver and Bile Passages.—REVIEWER.)

Soresi's method of establishing the continuity of the colon after resection by means of a piece of small gut is not new (Fig. 44).

In short, these experiments, while useful and suggestive, do not have the novelty or wide applicability ascribed to them by this author.

### THE APPENDIX.

**The Pathology of Appendicitis.** From his study of 1500 appendices removed at operation, Eli Moschcowitz<sup>1</sup> confirms the ideas of Aschoff, namely, that the pathological lesion of acute appendicitis represents a suppurative process from the very beginning. There is no evidence that an "acute catarrhal" inflammation of the appendix occurs. Further, there is no pathological evidence of "involution" of the appendix, or of "chronic catarrhal" inflammation of the appendix. *The changes associated under the name of chronic appendicitis (stricture, obliteration, etc.) are the healed products of the acute lesion.*

An acute, localized peritonitis, with the formation of fibrin and limited to the site of the lesion, is always present in acute appendicitis as early as twelve hours after the onset. Conversely, the absence of a localized peritonitis, which can be recognized by the observer's eye, is, in itself, evidence of the absence of an acute appendicitis. The cause of the peritonitis must be sought elsewhere.

Moschcowitz states the only justifiable classification of inflammation of the appendix is: (1) acute appendicitis; (2) healing or subacute appendicitis; (3) healed or chronic appendicitis.

In addition to obliteration and stricture, especial attention is called to two easily recognizable, constant and pathognomonic signs of chronic appendicitis (*i. e.*, healed appendicitis), namely: (1) Absence of mucosal crypts, and (2) marked widening of the submucous connective tissue zone. The latter sign is especially easy to recognize upon cross-section of the organ, and is recommended as the simplest means of determining the presence or absence of chronic appendicitis.

In examining an appendix, it is pointed out that cross-sectioning at various levels affords a better estimate of pathological changes than the customary longitudinal section.

The observations of Stanton<sup>2</sup> agree with those of Moschcowitz regard-

<sup>1</sup> Annals of Surg., 1916.

<sup>2</sup> American Journal of the Medical Sciences, April, 1915; Journal of the American Medical Association, lxiv, 1449.

ing the acute changes. Stanton says nothing about the healing or healed types of appendicitis.

**Bacteriology of Appendicitis.** According to Rosenow,<sup>1</sup> the colon bacilli present, are secondary invaders, whereas cultures from the wall of the infected appendix show that the chief invaders are streptococci.<sup>2</sup>

Under the title of "CRYPTOGENETIC PERITONITIS," Brunzel<sup>3</sup> reports 11 cases from the clinic of the late Sprengel, in Brunswick. The onset is sudden in children as well as in adults. It is frequently accompanied by generalized abdominal cramps, vomiting, diarrhea and fever. The physical signs in the lower abdomen are extremely variable. The diagnosis can only be guessed at. An absolute diagnosis can never be made. Of the 11 cases, only 2 survived. Although pneumococci were the most frequent exciting organisms; some of the cases were caused by streptococci or staphylococci. The infection comes by way of the blood stream, the source of infection being frequently the alimentary tract and particularly the anginas. Considered in this light, the condition is a pyogenic septicemia. The operative procedure consists in routine removal of the appendix (according to Sprengel), even if macroscopically normal, because this, as a source of infection, can never be excluded. In addition, a left-sided incision is made for the sake of drainage, and, at times, still another one in the median line for the same purpose.

Similar views are expressed by Anderson in discussing APPENDICITIS AS A SEQUEL OF TONSILLITIS. Anderson<sup>4</sup> points out that the appendicular involvement may be only part of a generalized infection. Hence, the gravity of such cases is out of proportion to the local symptoms, and, by analogy, the chronic tonsillar infections should be kept in view as the possible cause of similar infections of the appendix.

Anderson also remarks on the tendency for such cases to be atypical in their clinical course. For example, that local tenderness and rigidity may, in rare cases, be absent in acute appendicitis from this cause.

**Unrecognized Acute Appendicitis Associated with Gunshot Wounds of the Trunk.** Colley,<sup>5</sup> who was on duty in a hospital immediately back of the firing lines, reports the following unique case. A twenty-four-year-old, non-commissioned officer was admitted with a wound of entrance in the sixth or seventh intercostal space in the anterior axillary line. The abdomen was distended, the liver extremely tender to pressure, in short the patient showed signs of far-gone peritonitis. Five days later, at autopsy, two bullet tracts were found to have merely bruised the peritoneum without penetrating it; there was no injury

<sup>1</sup> Journal of Infectious Diseases, 1915, p. 240.

<sup>2</sup> See also Rosenow's Elective Localization of Streptococci reviewed above.

<sup>3</sup> Deutsch. Zeitschr. f. Chir., 133, p. 233.

<sup>4</sup> American Journal of the Medical Sciences, October, 1915, p. 541.

<sup>5</sup> Deutsch. med. Wehnschr., 1915, p. 43.

to any of the intra-abdominal organs. A suppurative peritonitis had its origin in a gangrenous appendix. The assumption that the trauma of falling to the ground consequent on being shot, caused rupture of the gangrenous appendix cannot be substantiated, as the patient stated that he felt perfectly well previous to being wounded.

**The Röntgen Diagnostics of the Appendix.** A. E. Barclay<sup>1</sup> finds that the appendix is demonstrable by x-rays in about 30 per cent. of the cases. Case saw the organ in about 50 per cent. of all cases, while George, of Boston, gives figures as high as 80 per cent. Barclay states that by manipulation one can tell whether the appendix is adherent or not, also whether it has a mesentery. Normal appendices point downward and are found lying free. Those pointing in other directions are often adherent. He says, "apart from making a negative diagnosis when one sees the appendix functioning and lying free, or from detecting adhesions, I have little confidence in making deductions from the appearances as to the presence of trouble caused by the appendix." As regards chronic troubles referred to the appendix, Barclay believes they are due to referred irregularities of the terminal ileum rather than with the appendix itself. Any small adhesions should be searched for and divided, no matter how insignificant their appearance.

**X-ray Findings in the Cecum after Appendectomy.** Case<sup>2</sup> observed that *cecal stasis* frequently followed appendectomy. In such cases, even several years after operation, a rounded residue of barium the size of a twenty-five-cent piece remained in the cecum after the colon had been cleared of the barium meal. This observation was frequently made in patients who complained of a tenderness over the cecum. In some cases this cecal stasis was present before the operation. However, Case emphatically stated that the condition often followed operation in cases in which it did not exist before. He considered that the stasis occurs at the site of the stump of the appendix and has some relation to the invaginating suture by which the stump is buried.

### THE LARGE INTESTINE.

**Intestinal Stasis.** An excellent constructive critique of the present status of this subject appeared in the *British Journal of Surgery* for April, 1915 (p. 574). There is such eminently sound wisdom in these remarks that they are quoted in part, with the regret that their authorship is unknown.

For more than a decade, Lane has been elaborating his doctrine of intestinal stasis. At first this merely formulated the connection between delay of the intestinal contents, the formation of certain

<sup>1</sup> British Journal of Surgery, April, 1914, p. 645.

<sup>2</sup> Journal of American Medical Association, lxxv, 1628.

thickened bands which tied the gut into various kinks, and a state of chronic auto-intoxication in which loss of flesh, abdominal pain, lassitude, and nervous depression were the chief symptoms. But of late years, the effects of intestinal stasis have more and more been said to be responsible for the direct or indirect causation of disease. And not only has the theory of the causative relation between stasis and disease extended, but the methods of treatment suggested have become more and more daring. At first the exhibition of paraffin, then the division of one or more kinks, was indicated. But soon the actual diversion of the small intestine into the termination of the large was regarded as necessary in order to avoid the cesspool of the colon. Evidence rapidly accumulated, however, that this ileosigmoidostomy must often be followed by a removal of the excluded colon, which otherwise became more of a cesspool than ever. And now colectomy—primary and complete—is boldly claimed to be the proper treatment to cure the evils of stasis in their worst forms. Is this theory founded on fact? Is it the discovery of a fundamental truth, or merely an alluring delusion? And further: If the theory be true in whole or in part, how ought it to guide our practice?

Does it follow that if stasis is the cause of a morbid condition, the treatment of the latter will consist, primarily, in removing the intestinal intoxication? Suppose, for example, that it was proved that arteriosclerosis was the result of a sedentary life; it would not follow that the treatment of advanced vascular degeneration would consist in athletic exercises. Similarly, if an ileal kink can cause cancer of the pylorus, this is not a reason for treating gastric carcinoma by colectomy. But what of less fatal diseases, *e. g.*, gastric and duodenal ulceration? It has never yet been proved that these result from stasis, though it is abundantly clear that the two conditions are often associated. But if the proof is forthcoming, it does not follow that colectomy rather than gastro-enterostomy is the proper treatment. In this connection it would be most instructive to know how many patients with both duodenal ulcer and intestinal stasis have had gastro-enterostomy performed without success, and who were finally cured by colectomy; and conversely, how many such sufferers have had a primary colectomy, and were not cured until the stomach and jejunum had been short-circuited.

To the extremists on both sides these questions will appear idle; but they may appeal to the moderate man, willing always to learn and yet unwilling to accept assertions without ample proof.

We still desire evidence on many points. For example: What constitutes intestinal stasis? Is it to be measured by an empirical time test? Can intestinal toxemia exist apart from morbid changes in the structure of the colon? To what extent is stasis, measured by time, any index to toxic absorption? Is stasis a purely mechanical affair, or does it

result from a neuromuscular disorder? In the association of two or three morbid conditions, *e. g.*, gastric or duodenal ulceration, appendicitis, and intestinal stasis, is one of these the cause of the others, or have they all a common origin? The same question may be asked of other combined conditions, *e. g.*, enteroptosis, neurasthenia, and stasis. To what extent are various diseases, *e. g.*, osteo-arthritis, tuberculosis, goitre, or Still's disease, due directly or indirectly to stasis? And in those cases where a causal relationship can be demonstrated, to what extent and in what stages of the malady, will cure of the stasis relieve the resulting general disease? How can intestinal toxemia be determined and how measured? What means are efficient for the cure of intestinal toxemia? Is intestinal toxemia to be regarded as a morbid condition arising in the colon or in the ileum? What is the mortality and what are the end-results of the division of bands, of short-circuiting operations, and of partial and complete colectomy?

The critique was ended by the expression of a hope that further articles may establish a knowledge by building up *sure* facts and demolishing any claims which may be only misleading fables, whether the latter be the product of effete conservatism or rash speculation.

THE PHYSIOLOGICAL AND PATHOLOGICAL ASPECTS OF INTESTINAL STASIS. The scholarly and logical exposition of the *motor functions* of the intestine by Alvarez<sup>1</sup> forms a striking and pleasing contrast to the pseudoscientific vaporings of the Lane school of clinicians. This article comprises so complete and succinct an exposition of the subject, that further condensation is impossible. Unfortunately the article's length will not permit of its reproduction in this review. No one who wishes to be *au fait* on this subject can afford to miss studying Alvarez's excellent compilation.

One cannot help sharing the sound, well-taken opinions expressed in Logan Clendening's polemic<sup>2</sup> against the assertions and practises of the Lane school. In the terms of modern slang "it was coming to them!"

A most valuable contribution to THE PATHOLOGY OF INTESTINAL STASIS appeared in the *British Journal of Surgery*, April, 1915, by Arthur Keith, the eminent anatomist. He inferred, from investigation of nodal structures of the heart, that there is a third kind of tissue—one intermediate between non-striated muscle and sympathetic nerve tissue. It is this intermediate tissue which is particularly endowed with an automatic power of originating contractile impulses and muscular movements. Seeing that the heart represents a very specialized form of musculature, it seemed highly probable that a more primitive form of nodal tissue should be found in connection with the non-striated musculature of the intestine.

<sup>1</sup> Journal of American Medical Association, lxxv, 388.

<sup>2</sup> Interstate Medical Jour., Dec., 1915, p. 1191.

In seeking for this more primitive form of nodal tissue, Keith recalled the complicated movements he had witnessed in the ileocecal region of the bowel of the rat some years previously when investigating the action of the ileocecal sphincter at the junction of the great and small bowels. It was quite clear that the complex movements of the cecum were initiated near the ileocecal junction. Serial sections revealed the presence on the outer surface of the sphincter of a ring or collar of large cells—some clearly nerve cells—which surrounded the termination of the ileum. These cells represented a specialized ring of Auerbach's plexus, but differed from Auerbach's plexus in that there was no sheath on the deeper, or sphincteric, aspect.

These cells—or certain intermediate members of this collar group—become continuous with sphincteric muscle cells so that it was hard to say whether certain elements should be grouped with Auerbach's plexus or with the muscle cells. From this, he concluded that Auerbach's collar which surrounds the ileocecal junction is nodal in its true nature and that it is the tissue in which cecal and ileocecal movements normally take their origin; and it is through this tissue that the central nervous system exercises its control over such movements. Keith's hypothesis is that the tissue which unites the plexus with the musculature of the bowel—this intermediate tissue being conveniently named Auerbach's tissue—represents the most excitable musculature of the intestines. This is corroborated by the fact that Auerbach's plexus and tissue are highly developed, and particularly well marked at the pylorus, the termination of the ileum and the descending colon, namely, those parts of the bowel where tonicity is particularly well marked. In regard to the large intestine, the distal part of the transverse colon and the descending colon, which are normally in a state of hypertension, have a richer supply of this tissue than the appendix, cecum or ascending colon, even allowing for the greater expansion or distention of the musculature of the cecum and ascending colon.

Keith examined six colons which had been removed for stasis. In 3 of them, there were definite lesions of Auerbach's plexus. In 2 of these, typical cases of mucous membranous colitis, Auerbach's plexus had at a late stage of the disease become affected by the process of fibrosis present in other coats of the intestine. The fibrosis was a secondary consequence of the primary disease. The findings in the last case (showing lesions of Auerbach's plexus) was particularly marked in the distal half of the transverse colon. Here, in conjunction with an atrophy of the muscle fibres of the longitudinal coat, a hyperplasia of Auerbach's tissue was present and Keith suspects that the hyperplasia and disordered motility of the bowel had some relationship.

Keith states, "I am convinced that, in the great majority of cases which are classified under the somewhat elastic term of intestinal stasis, the symptoms do not result from an atony of the musculature of the

bowel, but from a hypertonicity of those parts which are normally in a state of chronic contraction—such tracts as the terminal part of the ileum, and all that part of the colon which lies between the mid-point of the transverse colon and the junction of the iliac with the pelvic colon."

Speaking of stasis in the lower ileum, he says, "I agree with Dr. A. F. Hertz in regarding the late passage of the ileal contents as resulting not from traction of a peritoneal band but a hypertonus—a disordered action—of the ileocecal sphincteric tract." A colon and terminal ileum removed for ileal stasis and examined by Keith showed Auerbach's tissue well developed and normal in structure in the terminal part of the ileum. "That it might be normal in its microscopic structure and yet disordered in its action, becomes easy of belief from an observation made by Dr. T. R. Elliott. He found that adrenalin brought about a contraction of the sphincteric (hypertonic) musculature, and that it exercised its effect neither on the nerve nor on the muscle, but at the neuromuscular junction. I am proceeding on the assumption that the actual tissue, on which adrenalin acts, is Auerbach's tissue which I have defined above. It is far from improbable that there may be a disturbance in the action of the glands of internal secretion in the generic condition named 'intestinal stasis,' and in such a case we could scarcely expect to find any evidence of structural change in Auerbach's tissue. Although my investigations have not succeeded in finding a pathological basis for impaired motility of the colon, they may be of service in another way by drawing attention to our considerable ignorance concerning both the anatomy and physiology of the great bowel." (Keith.)

Speaking of bands as a cause of stasis, Keith says: "All the evidence I have been able to collect, convinces me that, in health, mesenteries take absolutely no share in supporting the abdominal viscera; for their proper support, viscera depend entirely upon the musculature of the abdominal wall." He concedes that the muscular support often gives way, and, in various forms of enteroptosis, as a consequence of this there is suspension of the viscera by the mesenteries and their vessels. He also concedes that congenital and acquired bands may cause intestinal obstruction, but, "If such be the case, is it not strange that so few examples of this form of obstruction have been placed on record?" As to the *x*-rays of stasis in the duodenum and lower ileum, submitted by A. D. Jordan (the röntgenologist who is a warm advocate of Lane's theories), Keith says, "in speaking of the duodenum, I have always considered it possible that in cases of enteroptosis the traction on the superior mesenteric artery might reach a degree sufficient to obstruct the passage of the intestinal contents from the duodenum. The *x*-ray pictures published by Dr. Jordan have firmly convinced me that, at least in his cases, the traction of the mesenteric artery cannot be the

obstructing force. The *x-ray* shadow ceases considerably to the right of the spinal column at a point well away from the line of pressure of the superior mesenteric artery." It is just at this point that Oehsner (referred to by Keith) has described a sphincteric thickening of the musculature of the duodenum. As to ileal bands causing obstruction, Keith says, "the *x-ray* pictures of obstruction caused by ileal bands are not such as we should expect from this method of construction of the bowel, but are exactly what we should look for in a case of hypertonicity of the terminal ileal sphincteric tract. Not a single *x-ray* picture has been published which shows a permanent narrowing or constriction of the ascending colon or of the hepatic flexure, such as we should expect from a band or kink.<sup>1</sup> On the other hand, scores of *x-ray* photographs have been placed on record which show a hypertonicity in the distal half of the transverse colon and in the descending and iliac tracts of the colon. The *x-ray* and anatomical evidence is altogether against the theory which regards peritoneal bands and kinks as the cause of chronic obstruction of the bowels, and altogether in favor of a *disordered action of the intestinal musculature.*" . . . "The remedy will be found in a fuller knowledge of motor mechanism of the bowel."

Speaking of Lane's theory that the large intestine is a mere sewage system, Keith disagrees, saying: "We must remember that if the colon's mucous membrane is a purely glandular structure of unknown—at least uncertain—function, if we bring the glandular tissue together to form a solid mass, we have a gland considerably larger than the pancreas. All its cells are active. If we roll up its musculature, we have a mass of contractile tissue, furnished with an elaborate and complex neuromuscular system, big enough to form a muscle as large as the biceps of a blacksmith's arm. That is not quite the composition we expect in a merely mechanical effluent sewage system. The fact that health can be maintained after complete removal of the colon does not prove that it is either a useless or a vestigial structure; it is simply another example of the well-known law that nature has endowed the animal body with a potentiality far beyond the demand of a routine life.

"I particularly wish to insist on the unknown utility of the great bowel, because, if we consign it to the list of useless or of injurious organs, then we cease to regard it as an object which urgently requires research and investigation." . . . "There is no doubt that in all cases of intestinal stasis there is a disorder of the neuromuscular mechanism of the great bowel, but we cannot explain that disorder in the present state of our knowledge" (Keith).

<sup>1</sup> In one specimen the colon was sharply kinked at the hepatic flexure by a modified form of Jackson's membrane, but this kinking in no way interferred with the lumen of the bowel. It was easy to pass three fingers at once around the bend. The obstruction was more apparent than real. Microscopically the musculature and nerve plexus showed no pathological changes at the hepatic flexure.

Keith is convinced that the operation of colectomy is justifiable for chronic inflammation of such long standing that repair is impossible. As to removal of the colon for stasis, "the operation, though justifiable from a clinical point of view, cannot be supported from an anatomical one." The lesions found by him in specimens of this sort were not beyond repair. "With a better knowledge, it should be possible to restore such cases to health (without operation)."

In a later communication,<sup>1</sup> Keith summarizes his views as follows: "There is a striking parallel between the rhythmical contractions of the heart and alimentary tract. In the heart one finds two zones, an auricular and a ventricular; in the normal heart the sino-auricular node is the pacemaker. Irregularities of the same sort, such as are known to occur in the heart, may also occur in the nodal and conducting system of the alimentary canal. Here, instead of two zones as in the heart, there are a series of zones or segments, each furnished with its own pacemaker and own rhythmical contractions. When irregularities or blocks are present, one would expect to find them at the point where one rhythmical zone or area passes into the succeeding zone. This is exactly what occurs. Thus, one finds a block where the esophagus joins the stomach (cardia); another where the gastric zone ends and the duodenal begins (pylorus). Also one finds blocks at the point where the duodenal zone passes into the jejunal (duodenal sphincter of Ochsner) and where the jejunoo-iliac passes into the ileocolic (producing stasis in lower ileum). At all these points sphincters are situated, and Keith believes that the mechanism of such sphincters may become disordered and cause stasis of the alimentary contents. He adds, however, that such a disturbance in the action of a sphincter is but part of the disturbance which affects the entire rhythmical segment to which this sphincter belongs.

To obtain an orderly propulsion of the food along the whole length of the alimentary canal, those rhythmical zones must be closely coördinated in their action, and there is a growing body of both experimental and clinical evidence (see Alvarez's review above) which points to close coöordination by means of a complicated system of reflexes. Disturbance in any one segment upsets the rhythm in all the segments. Disturbance in the excitability and rhythm of the pacemaker of the cecum will be reflected to the lower ileum. One can understand how stasis in the great bowel may be followed by ileal stasis, duodenal or gastric stasis, or how a disturbance of the conductivity or excitability of any of the rhythmical zones may ultimately give rise to stasis in all.

W. B. Cannon<sup>2</sup> states that the material coming from the small intestine is almost wholly water and waste. The colon may be regarded

<sup>1</sup> *Lancet*, August 31, 1915, p. 371.

<sup>2</sup> *Journal of American Medical Association*, lxxv, 194.

as a waste receptacle. The bulk of the waste is reduced by the removal of water, and this is accomplished by reverse peristalsis, the water being thrown back into the *caput coli* where it is absorbed. Material in the upper colon is nearly as dry as that in the rectum. This reverse peristalsis may be seen in the left colon, this being excitable there by the presence of soft material. Hardening of the feces excites peristalsis toward the rectum. So far as the physiological functions of the right colon are concerned, they can be assumed by the left and transverse colon after removal of the ascending colon. Animals that are weak and toneless as to skeletal muscles, have an equal toneless state of the smooth muscles.

Sandrock<sup>1</sup> found the acidity in gastroparesis is largely influenced by the amount of associated atony—the greater the atony, the lower the acidity.

In 2 out of 4 cases in which a Finney pyloroplasty had been done, Case<sup>2</sup> found that the rapid exit of the food from the stomach was prevented by the formation of rhythmically contracting constriction rings in the duodenum. This finding coincided with the experimental observations of Cannon and Blake. Case adds the interesting observation that analogous phenomena were noted in a large number of cases in which the usual gastrojejunostomy had been performed, namely, that a sort of sphincter action had become established in the jejunum at a point varying from 3 to 6 cm. below the gastrojejunal opening. This was at first interpreted as a spastic contraction of the circular muscle of the jejunum; but, in the light of Cannon's observations on rhythmic contractions of the duodenum after pyloroplasty, it seems reasonable to conclude that this contraction ring in the jejunum was serving somewhat as a sphincter, thus simulating the normal action of the pyloric sphincter. "Under the fluorescent screen one sees a small, finger-like shadow gradually build down behind the gastric silhouette simulating very much the formation of pseudopodia in the ameba. This finger-like shadow projects farther and farther until it is suddenly constricted an inch or two below the stomach, the pinched-off bolus passing onward into the distal small bowel, the proximal portion remaining and gradually assuming larger proportions until the distal portion of it is again pinched off by succeeding contractions. In other words, this action has, in a certain degree, seemed to take the place of the rhythmic contraction normally occurring at the pylorus.

Another point observed by Case related to stagnation of food in the jejunum at or near the site of the gastro-enterostomy. Toward the end of gastric clearance there occurs a stagnation in the small bowel at the site of the anastomosis, this stasis being accounted for by the inhibition of onward peristaltic activity at this point.

<sup>1</sup> Bulletin of the Johns Hopkins Hospital, July, 1915.

<sup>2</sup> Journal of American Medical Association, lxxv, 1628.

A. E. Barclay,<sup>1</sup> according to the reinvestigations of recent years, shows that the conditions of stasis with which the surgeon is called upon to deal, are those associated with faulty *mechanism* rather than faulty *digestion*. There is a tendency to forget that there is a chemistry as well as a mechanism of digestion. Too much stress is often laid upon the mechanical factors. In discussing these mechanical factors, Barclay points out that the origin of irregular muscular contraction is being sought at the present time. "Investigations show very clearly that the whole musculature of the alimentary tract is linked up by a nervous system probably as complex as that of the brain itself. This system is subservient to the central nervous system, but is also capable of automatically exercising its elective action on ingesta, of calling secretory glands into activity, of preparing the tract for food that is coming (*i. e.*, emptying the ileum when food is taken into the stomach) and many other functions that we hardly suspect as yet." Regarding what investigation may bring forth, he says, "Some day these larger (surgical) operations will be unnecessary, but that day is not until we can place a finger on the exact spot where the trouble arises. In the meantime one is astonished, not at the brilliance of the surgery displayed, but by the tolerance of the human body." . . . Again, "Wide variations from the standard may be quite normal. The only real test of abnormality is functional disability. When one sees such extreme cases as women who are perfectly healthy, and yet defecate but twice or thrice a month, one is not justified in dogmatizing on the subject of stasis in the large bowel. Some individuals may not be able to acquire a twenty-four-hour standard for defecation. The persistent use of purgatives in such cases is likely to lead to real trouble in the course of time. One sees so many instances of women in whom the opaque meal takes forty-eight hours or more to reach the rectum, in spite of the fact that the whole tract has been cleared out by preparation, that one believes, in many of these the natural habit would be forty-eight hours or more. There are others with the habit of two or three stools a day who live in apparently perfect health."

"It has been shown that the food passes into the cecum in part by pressure from behind, *i. e.*, that the ileocecal valve acts as a sphincter and that its function is not only to prevent regurgitation but to regulate the onward flow of chyme from the ileum into the cecum. *Ileal stasis is, up to a point, a physiological condition.* A collection of material should be found in the terminal ileum in about three hours from the time the food is taken, while the coils should be nearly empty in eight hours. These approximate figures may vary within wide limits, as shown by the following observations representing two extremes: On the one hand, in duodenal irritation, it has been observed that shadows

<sup>1</sup> British Journal of Surgery, April, 1915, p. 638.

arrive at the ileocecal valve in well under half an hour, whereas in delayed emptying of the stomach it may be an indefinite time before the food reaches this point. It is therefore very difficult to state exactly what constitutes ileal stasis. Not only have we this factor to consider, but also the knowledge that accumulation of feces in the cecum will give rise to back pressure and in every case of constipation, when the cecum is loaded one will see evidence of ileal stasis, but this form of stasis is readily dissipated by means of a purgative or an enema. Many such cases have been labelled ileal stasis, and have been published as such. On inquiry one finds that these patients have not been prepared and that no preparation is undertaken *because* no ileal stasis is found after the bowels have been cleared. Surely, if this is the case, the symptoms cannot be due to ileal stasis, or, a simple purgative would invariably relieve the condition and cure the symptoms. To avoid error, therefore, it is necessary to prepare patients carefully for  $\alpha$ -ray examinations in order, on the one hand, not to observe a stasis that is really nothing but back pressure from cecal constipation, or, on the other, if purgatives are still exerting their influence, to have the tendency to ileal stasis obliterated." Barclay employs practically the same methods as those advised by Carman. The bismuth meal is composed of actual food (bread and milk) with barium mixed into it.

*Anatomy:* "The terminal ileum's last four inches differ in structure and perhaps in function from the rest of the ileum. This portion does not pursue a tortuous course, but runs more or less straight upward and outward to the cecum. Its caliber is smaller, and the chyme forms a continuous shadow which is quite different from that in other parts of the small intestine. It looks as if the circular fibers were more evenly developed, and tonic action a more persistent feature of the muscular contraction. One believes that the whole of this terminal portion is closely associated with the sphincteric and valvular action that is ascribed to the ileocecal valve itself. As regards the flexures of the colon, they may look at first sight as if they were acute angles in the gut, but this is not so. It is due to foreshortening of the two limbs of a U-shaped bend."

*Physiology.* Barclay noted a close connection between the ileocecal region and the duodenum. Taking food into the stomach tends to make the ileum empty into the cecum. In other words, a definite ileo-pyloric reflex exists. In certain cases of duodenal irritation the stomach begins to empty very rapidly, overloading the small intestine in a short time (within three-quarters of an hour). With a small quantity of food the stomach is empty, and yet, when a larger meal was given, it was found that instead of being empty in the usual four hours, there was actual delayed emptying, and in some cases fully a half was still present in the stomach after seven or eight hours. On watching the progress of the food below, one noted that when the shadows reached the

terminal ileum, this rapid emptying and general activity of the stomach ceased, and in each case there was well-defined ileal stasis with no food passing on into the cecum. These observations give the impression that the terminal ileum is abnormal in some way, and that, when once the food gets down to this point, it causes a reflex closure of the pylorus and quieting down of the gastric activity. Operations on all these cases showed evidence of old inflammatory changes in the ileocecal region.

Lane's kink has not been recognized radiographically by Barclay, and he is far from convinced that it is a cause either of ileal stasis or of this ileopyloric reflex.

Normally, the ileocecal valve is resistant to the entrance of opaque enemata in all but 16 per cent. of the cases. In one case of Barclay's, he saw the injection flow quite freely, not only into the ileum, but also into the jejunum, and some of it was actually located in the duodenum. The query of Cole is cited in which is questioned whether the small intestine will tolerate regurgitated fecal matter without giving rise to symptoms of some kind, probably referred to the stomach.

The findings of Marcuse<sup>1</sup> are of interest in this connection. He examined a large series of patients with the *x*-rays and controlled his observations at subsequent operations. He concluded that insufficiency of the ileocecal valve is by no means a symptom of chronic appendicitis. It occurs in quite healthy people, as well as in those who have chronic pathological processes in the region of the cecum. It is merely an interesting coincidental finding of no diagnostic value.

MOVEMENTS OF THE LARGE INTESTINE. The normal movements of feces through the large intestine is by a "mass" movement, in which a large column is moved through a long section of the colon in a few seconds. These movements take place probably three or four times a day. The mass movements do not occur in the cecum. The calls to stool do not necessarily follow one of these movements. The whole process is over in a very short time and the haustral segmentation and general picture of still life are almost immediately restored. Constipation occurs as the result of stagnation (*a*) in the sigmoid and rectum, *i. e.*, inefficient defecation or dyschesia, and (*b*) in the cecum, constipation proper. The latter is probably the result of a defect in the mechanism of the "mass" movement. It is suggested that, for the efficiency of this movement, it is necessary that a sphincteric contraction should be present. The competency or otherwise of this sphincter (primary contraction ring of Cannon) determines whether the "mass" movement, when it occurs, propels all of the feces forward or sends some of them back into the cecum. *The large flabby cecum is the result of inefficiency, not the cause of constipation* (see Rost below). Barclay ventures the opinion that the cecum has a separate mechanism or peristalsis for mix-

<sup>1</sup> Berl. klin. Wehnschr., 1914, No. 51.

ing the contents and feeding them into the ascending colon, preparatory to the occurrence of the "mass" movement. On two occasions, Barclay was able to observe the formation of a definite constriction, such as he considered necessary for the efficiency of the "mass" movement. In each case it was near the hepatic flexure, and was not evident until it had been palpated out with a spoon which he uses as a distinctor. In another instance he saw such a constriction at the splenic end of the transverse colon. The colon, distal to the point of constriction, lost its haustral segmentation, and the contents seemed to back up to the point of constriction as if forming a mass ready to be propelled onward when the "mass" movement took place. Barclay believes that the keystone to the efficiency of the movements of the large intestine lies in the competency of the constriction point, and that it is on the competency of this temporary sphincter that the natural action of the bowels depend. In other words, constipation means ineffectiveness of the "mass" movements.

POSTOPERATIVE X-RAY EXAMINATION after partial colectomy shows the remains of the colon apparently normal. The striking feature is the absence of any definite division between the large and small intestines. In fact, in a few cases, Barclay noted that a portion of the ileum seemed to have taken on the *x-ray* appearance of the colon. (See Case also.)

X-RAY EXAMINATION OF THE LARGE INTESTINE FOR NEOPLASTIC CONSTRICtIONS is best accomplished by an opaque enema; watching the course of the injection as it ascends to the gut. With the aid of palpation under the screen, one can form a very good idea of the nature and extent of the lesion. In case of doubt, reëxamination is necessary to prevent mistaking spasmodic contractions for organic constrictions. In early cases there is no dilatation proximal to the colon. The bismuth meal shadow gives very little hint as to the site of obstruction. Only in advanced cases is there ballooning of the bowel, and in this type one sees antiperistalsis most frequently. Carman's opinions coincide with this.

Like Barclay, Smithies<sup>1</sup> points out sources of error in the technic employed by those who are adherents of Lane's theories. For instance, Jordan's published report definitely states that the opaque motor test meal is administered to stasis cases without the bowels previously having been emptied. According to Smithies, who has a large experience, the only reliable information about the motor power of the gut can be obtained when a meal is administered by mouth after the intestinal canal has been thoroughly cleaned out twenty-four hours previously. Further, the psychic control of gastro-intestinal motility is a factor which must be considered. It is therefore not surprising to find a certain

<sup>1</sup> Surgery, Gynecology and Obstetrics, January, 1916, p. 57.

degree of inertia after ingestion of the bismuth meal, when one realizes that to many people the meals are disgusting. Such delay cannot be considered abnormal. Expressed in another way, "It does not seem altogether clear why we should expect large volumes of bismuth administered to an ailing patient to pass through the bowels as does a meal that the patient himself has chosen according to his own desire, and which consequently excites the secretions of the gastro-intestinal canal and which stimulates its physiological motor apparatus."

There are great variations in absolutely normal persons. Thus, individuals in perfect health showed retention of the opaque meal in the colon from three to five days. In contrast to this, patients with obstinate constipation, whose bowels had been previously cleared out by a cathartic, evacuated the motor meal within forty-eight hours. If a normal individual were repeatedly examined, it was ascertained that there were wide variations in the time required for the opaque meal to pass through the gut.

Mixing non-diffusible material, such as carmine or lycopodium, with food of the patient's own choosing, it was Smithies's experience that the majority of patients who claimed that intestinal stasis of the obstinate type existed, passed stained stools well within the time limit of people with normally acting bowels. In the few cases in which this did not occur, stained material was demonstrated in the sigmoid and rectum awaiting evacuation. Smithies points out that this simple method for determining the presence or absence of actual stasis offers great possibilities in the selection of individuals for different forms of therapy.

Incompetency of the ileocecal valve and variations in the position of the colon bear practically no relationship to the presence or absence of intestinal stasis. (See opinions of Barclay and Marcuse above.)

According to Smithies, the chemical and bacteriological studies of Mutch (see review below) require corroboration before being accepted.

Both the Röntgen picture in organic stenosis of the gut, either partial or complete, as well as the clinical picture, tell an entirely different story from the "stasis" cases.

As regards the so-called toxemia from intestinal stasis, Smithies says, "I have been frequently impressed with the history of *chronic under-nourishment* in many of these cases. This under-nourishment has frequently antedated the onset of the chronic constipation. The majority of these individuals give some *history of previous infection*, and local foci of chronic infection can usually be demonstrated. Thus, decaying teeth, pyorrhea alveolaris, infected tonsils, sinuses or lymph glands, diseased appendices, gall-bladders or adnexa are common findings." Smithies feels that this association of chronic, partial starvation, particularly in females, and the presence of germ centres in some part of the body, cannot be too strongly emphasized with regard to the

subsequent onset of "intestinal stasis." As to the surgical indications, if, in spite of the most painstaking medical care, a case finally comes to laparotomy, the laparotomy should be exploratory in the fullest sense of the term. Very often the removal of an infected appendix or a gall-bladder filled with stones, a gastroduodenal ulcer or diseased adnexa, will render unnecessary the uncertain short-circuiting operation or partial colectomy.

**OBSTIPATION.** Rost,<sup>1</sup> an assistant of Wilms at Heidelberg, divides the types of obstipation into five as follows:

1. *Dyschezia*—proctogenous obstipation—due to: (a) congenital anomalies causing mechanical hindrances in the region of the rectum or adjacent gut. (b) Spasm of the sphincter ani. (c) Disturbance in motility of the lower colon. These may be of reflex origin.

A combination of these three factors often occurs. Stasis of contents in the beginning of the colon is often observed in this type of obstipation. Resection of cecum and ascending colon does not relieve the condition.

2. The spastic forms of obstipation affecting the intermediate and distal parts of the large intestine. The stasis in the proximal colon is secondary to these. Inasmuch as the symptoms of toxemia from resorption are improved after resection of the cecum and ascending colon, this is explained by the fact that the fluid from the ileum now immediately distends the spastic portions of the large intestine.

3. Primary obstipation from mechanical hindrances, such as (a) abnormalities of the parietal peritoneum; (b) atonic enlargement of the proximal colon; (c) pericolitis.

4. *The majority of cases of obstipation with stasis in the proximal colon* belong to none of the above groups, but depend upon a loss of physiological balance between the contractile power of the proximal colon and the resistance offered by the distal portions of the colon. The microscopic findings in the large intestine obtained at autopsy on two cases are then given: In one, there was a hypertrophy of the proximal, and an atrophy of intermediate and distal portions of the colon. The original site of obstipation was in the lower half of the colon. The resected ceca obtained from operation on such cases also showed hypertrophy. Symptoms are referred to the proximal colon in these cases. Following its operative removal, such symptoms cease, although the essential causative factor has not been affected. Improvement depends upon the degree of insufficiency present in the intermediate and distal portions of the colon.

5. In the last group of cases the proximal colon is so weak that it already fails to properly functionate in the presence of moderate mechanical hindrances, such as cecum mobile, adhesions, bands, etc. As a

<sup>1</sup> Mitt. a. d. Grenzgeb. d. Med. u. Chir., 1915, No. 4.

rule, cecopexy and freeing of the adhesions gives relief, but in some cases the colon is so weak that its side-tracking is often required because one can never determine the exact degree of insufficiency either before or during operation. From all this the reader will gather that the pathological concepts of Rost coincide fairly well with those of the English and American authors mentioned above.

PERICOLITIS, JACKSON'S VEIL, ETC., ASSOCIATED WITH INTESTINAL STASIS. A. G. Gerster<sup>1</sup> urges that more attention be directed toward a study of the etiology of these conditions with a view to rational preventive treatment rather than to the surgical measures, such as entero-anastomosis, division of bands, etc., designed to alleviate what he considers end-results of a long-standing, vicious intestinal habit.

This author stated that when he first read about the subject he failed to be impressed, but when he began to observe cases in which there had been pain in the right iliac fossa with fever, constipation, vomiting, and all other symptoms of appendicitis, and where, after removal of this appendix, which incidentally was found to be of normal appearance (see also visceroptosis simulating appendicitis described by Walton, below), such attacks were repeated, it seemed as though the chronic enteritis (or malfunction) was at the bottom of the matter. In such cases, therapy is medical, becoming only surgical when obstructive symptoms are present. Gertser stated that he had once seen a case of obstructive ileus with gangrene of the ascending colon due to contraction of the hepatocolic band.

"Without accepting Lane's fanciful pathology, we may say that to him belongs the merits of having made the first attempts at explaining and remedying a condition previously much neglected and unrecognized. His endeavors are directed toward the elimination of organs that have become useless and detrimental. Much more meritorious will be the work of those who will clear up the pathology of the beginnings of constipation, and will thereby prevent the necessity for Lane's heroic surgery."

Eastman<sup>2</sup> says: "I have produced in rabbits a colon stasis by prolonged intermittent ligation of the anus, and such an artificially induced colon stasis resulted in colitis after a few weeks in the formation of plastic peritoneal adhesions which were drawn out into membrane form by the normal movement of the large intestine."

That stasis of intestinal contents does not necessarily lead to the production of pericolic membranes is shown by the following case of megacolon in a boy aged thirteen years, reported by Abell.<sup>3</sup> After an attack of scarlet fever, at the age of seven years, there was thrombosis of the left popliteal artery with temporary circulatory disturbance.

<sup>1</sup> *Annals of Surgery*, July, 1915, p. 74.

<sup>2</sup> *Ibid.*, March, 1915, p. 334.

<sup>3</sup> *Surgery, Gynecology and Obstetrics*, June, 1915, p. 685.

This thrombus formation was repeated in the pelvic veins, with obstructed venous return in the right leg, edema of the hip, etc. Constipation was first noted during the attack of thrombophlebitis. After this had been present for a year, abdominal distention began to be noted. The condition persisted and the size of the abdomen gradually increased. The patient slept in the prone position and there was a constant flow of semifluid feces during sleep. While the patient was awake fecal evacuation could only be obtained upon his resuming this same position of lying upon the abdomen. There was a stricture two inches above the levator ani muscle, which, upon dilatation, permitted the escape of feces from the enormously distended large intestine. Previous to operation, there was no obstruction to the flow of the barium enema into the large intestine, but there was a valve action which prevented escape of intestinal contents except in the prone position.

Here, in short, was the most marked intestinal stasis of at least six years' standing, and yet, upon opening the abdomen, while the large gut and lower part of the small intestine were greatly dilated, nevertheless, there was no marked membrane formation. This would seem to indicate that pure mechanical obstruction does not lead to the development of Lane's kink or Jackson's membrane. At present we do not know the factors which make for infection of the intestinal mucosa or the penetration of such infection to the serous surface of the gut.

Wallace and Cameron and Hertz, having observed pericolonic adhesions and pericecal membrane frequently in adults and occasionally in young infants unassociated with constipation, conclude that such pericolonic bands can neither be the cause nor the effect of constipation.

Another side of the symptom-complex of intestinal stasis is shown in a most instructive paper by Albert J. Walton<sup>1</sup> entitled:

THE CLINICAL ASPECTS OF VISCEROPTOSIS. Although but few cases of marked intestinal stasis had come under his observation, yet a considerable number of the minor degrees of this condition were sent to him for treatment in the past few years, and, since the majority were sent with other diagnoses, it became more and more clear that the symptoms fell into several groups as they simulated one or other of the more readily recognized abdominal lesions. In the earlier cases it was impossible to make a diagnosis, but a careful study of the symptoms of each showed more and more clearly that the mimicry was incomplete. "Indeed, were it not for the fact that the condition of visceroptosis is occasionally associated with gall-stones, or with gastric or duodenal ulcer, there would be little or no difficulty in deciding that an individual case was one of visceroptosis."

For the purpose of throwing light upon the question of differential diagnosis, Walton cited a series of 67 cases seen by him during the past four years. These resolved themselves into the following groups:

<sup>1</sup> British Journal of Surgery, October, 1915, p. 185.

*Cases Resembling Appendicitis.* Of these, there were 29; 13 resembling acute, and 16 chronic, appendicitis. This group did not include cases of true chronic or acute appendicitis in which visceroptosis was also present, "a combination which is not at all uncommon." With increased experience, it was possible at times to make the correct diagnosis before operation. The relative frequency of true appendicitis to this simulated type was shown by the fact that Walton had 373 cases of true appendicitis during the same period of time.

*Acute Appendicitis.* "It has probably been the lot of every surgeon to operate on cases which he believed to be acute appendicitis in which the appendix itself was found to be in a more or less normal state. Such cases naturally did not find their way into the literature, because most surgeons would have been unwilling to record what they considered a weakness in their diagnostic capabilities. Of these 13 cases, only 2 were males. The patients invariably made a smooth recovery after operation, and were free from pain for a month to six weeks. Afterward there was a recurrence of the attacks of pain. This occurred in 7 of the 13 cases. The attacks could generally be relieved by the use of liquid paraffin, the administration of abdominal massage and exercise, combined with the use of an abdominal belt."

*Chronic Appendicitis.* Of this series 13 of the 16 cases were in females. It was noticeable that although the patient complained that the pain was so severe as to entirely disable her, and that this pain was present while the examination was being made, nevertheless she presented no great evidence of discomfort. It was also noticeable that the attacks of pain invariably started in the right iliac fossa and were frequently associated with headache and constipation. As in the acute cases, there was a large, movable cecum found at operation with a distinctive Jackson's membrane frequently, but the fibrous accessory membrane on the under surface of the mesentery close to the terminal ileum (Lane's kink) was more frequent. Removal of the appendix, division of the Lane's kink, and divisions of the Jackson's membrane which appeared to give rise to kinking were not constantly followed by permanent relief; 5 of the 13 were absolutely cured, but the remaining 8 showed only slight improvement; 3 showed no relief at all, the symptoms being as marked a week or two after operation as before. Adnexal disease and ureteral calculus could be excluded. These cases likewise were more or less relieved by an abdominal belt and liquid paraffin.

*Differential Diagnosis from Cases of Appendicitis.* The location of the pain from the very beginning in the right iliac fossa, plus tolerance to palpation out of proportion to the subjective statements regarding the pain, and the evident good general condition of the patient of visceroptotic build, are strongly suggestive. "However, if the attack has only lasted a few days, diagnosis may be impossible, for all are conversant

with those cases in which the symptoms are very slight and yet a gangrenous appendix is found at operation. Hence, in cases of doubt it is always better to operate."

*Cases Resembling Gastric Ulcer* were 27 in all. In 5 of these, gastric or duodenal ulcers were actually present. The remaining 22 showed visceroptosis alone. The statements of Lane regarding the frequent incidence of a kink of the terminal ileum, associated with gastroduodenal ulcer, are refuted by Walton. Of 83 cases of gastric ulcer, in only 4 was there a definite kink of the terminal ileum; and of 38 cases of duodenal ulcer, only one showed the presence of the Lane's kink. It was far more frequent to find an ulcer without visceroptosis than with it. In all cases of gastric or duodenal ulcer, the cecum and appendix were examined as a routine matter to determine this point. The attacks of epigastric pain, as a rule, were much shorter than the typical attacks in gastroduodenal ulcer cases. Frequently they only lasted for two or three days. They recurred at more frequent intervals than in true ulcer, and, during these intervals, there was not that complete relief which is so marked a feature when an ulcer is present. In the only case where there was true relief from the taking of food, a duodenal ulcer was also present.

A most suggestive fact was that the recumbent position would at times afford relief. Vomiting was a very common symptom, occurring several times a day, small in amount and often consisting of only frothy mucus. The fact that this afforded no relief, or only partial relief, was strongly suggestive of the absence of ulcer.

Hematemesis occurred in half the cases (11 out of 22). Walton favors the view of Bolton that this is due to multiple small erosions. Loss of appetite during the attack was from actual loss of desire, not simply from the fear of taking food owing to the subsequent pain it might produce.

At operation, not a trace of gastroduodenal ulcer could be found; the stomach was prolapsed and U-shaped; there was a well-marked Jackson's membrane, and a well-marked Lane's kink. The results of operative treatment could not be considered satisfactory. Like other well-informed surgeons, Walton states that gastro-enterostomy is useless for the relief of such a condition and should not be performed.

*Cases Resembling Cholelithiasis.* There were 6 in all, 2 in males and 4 in females. Like patients with actual cholelithiasis, there was slight comfort and discomfort and fulness in the epigastrium and right hypochondrium coming on immediately after food, or even before the meal was finished. Flatulence was a very marked feature, and eructation of gas would be followed by considerable relief. Vomiting did not occur unless the pain was severe. In 2 of the cases the kidney was so movable that a nephorrhaphy was performed. In both these

there was complete freedom from symptoms after operation. In the others, cure was temporary. Where nothing but division of bands and adhesions and removal of the appendix had been done, the relief was temporary, the symptoms recurring within two or three months. Wearing of a belt did not help these patients. In this class of cases, Walton also concedes that it may be impossible to arrive at a certain diagnosis without an exploratory laparotomy.

*Cases Resembling Carcinoma of the Stomach.* There were 5. They all gave a short history of three or four months' pain, with no remission, but a constant discomfort. Vomiting gave no relief. Like in the cases simulating gastric ulcer, there was loss of desire for food with consequent loss in weight. In every case the nervous system was examined to determine the presence of knee-jerks, and the condition of the eyes to preclude the possibility of an unrecognized tabes dorsalis. Walton believes that it is wiser to perform a laparotomy if any doubt exists in such cases rather than take the risk of leaving an early carcinoma unoperated upon. The results of operation were not satisfactory. There was a relief of several months, followed by a recurrence of symptoms.

He ascribes the relief in all these cases of visceroptosis to the leading of a rational, quiet life, with recurrence as soon as the patients resume their ordinary unsuitable habits.

*OPERATIONS FOR RELIEF OF INTESTINAL STASIS. The Technic of Ileocolostomy and Colectomy.* Lane's<sup>1</sup> indications for performing colectomy or ileocolostomy are stated by him as follows: "Personally, I perform colectomy in preference to ileocolostomy when the condition of the patient and the state of the large bowel are such that removal of the large bowel does not place the patient's life in more danger than I feel is justified by circumstances. It is sometimes very difficult to decide this point."

One can easily imagine the storm of criticism which such loosely formulated indications would arouse if put forward by any other than an authority as widely known as Lane.

Lane himself concedes that a fair number of patients complain of trouble after ileocolostomy and are obliged to submit to a subsequent colectomy. Of colectomy, he says, the chief disadvantage consists in adhesions between the small intestine and abdominal wall. Absence of the great omentum removed in the course of colectomy, probably has much to do with this.

Lane opens the abdomen by a vertical incision to the left of the middle line in order to divide the sheath of the rectus twice and so obtain a more secure abdominal scar.

<sup>1</sup> British Journal of Surgery, April, 1915, p. 599.

*Ileocolostomy.* After opening the abdomen, the ileum is grasped by two pairs of forceps whose blades are placed in immediate contiguity at a point five or six inches from the ileocecal junction. The gut is divided by a cautery between the two clamps. The distal aperture is closed by a running stitch, and buried by a purse-string suture. The proximal end of the bowel is then inserted into the pelvic colon at its upper part. This is an end-to-side anastomosis with two rows of sutures and even a third exteriorly in case any doubt as to the security of the stitch is felt. After this the intestines are drawn out of the pelvis, and the adjacent surface of the pelvic colon is carefully sutured to the divided margin of the mesentery of the ileum. Lane justly lays stress upon this point because an opening would permit the small intestine to prolapse through it, and possibly lead to intestinal obstruction. A tube is now passed through the anus up into the pelvic colon, and, guided by the fingers, through the ileocolic junction into the ileum for about eight inches. Its extrusion is prevented by a suture through the margin of the anus in the male, or the back of the labium in the female. If any difficulty is experienced, some liquid paraffin facilitates the passage of the tube along the intestine. By this means the accumulation of gas in the small intestines is prevented and the free passage of fluid contents past the junction is assured. The patient can be fed almost immediately after operation in many cases. In order to diminish the tendency, to adhesion-formation, two pints of warm saline are left in the abdomen and the patient is moved about from side to side at frequent intervals. Lane considers this after-treatment even more important in colectomy than in ileocolostomy.

*Colectomy.* Lane describes two types of abdomen encountered in performing colectomy. These form two extremes. In one the operation is extremely easy because the large bowel is loosely attached to the parietes, consequently its removal is effected with ease and rapidity. On the other hand, in certain fat individuals the large intestine may be fixed at every possible point by means of abundant "evolutionary bands," and, with very short mesenteries, renders the technical removal and entero-anastomosis very difficult. Lane states that it is in this latter class that the surgeon is tempted to perform ileocolostomy rather than take the risk of removing the large bowel. He says that in this type of patient there is less tendency toward postoperative adhesions between the small intestine and the abdominal wall. The technical difficulties of liberating the colon, which is bound down not only by a short mesentery but by evolutionary bands, is considered by Lane as probably responsible for the operation of partial resection of the colon. Lane experienced the same difficulty many years ago and consequently resected the large intestine as far as the middle of the transverse colon. He says, "I very soon found the futility of this method since the obstruction afforded by the splenic flexure and last kink militated greatly

against the success of the operation.<sup>1</sup> By separating the acquired from the normal, mesenteries, the splenic flexure can be dealt with with great ease and at no risk.

*Technic.* If the freeing of "evolutionary adhesions" from the mesentery is done carefully, the outer peritoneal aspects of the mesenteries are left smooth and intact. By doing this not only is the removal of the bowel greatly facilitated, but little or none of the mesentery is denuded of its peritoneal covering, lessening the risk of adhesions between raw surfaces left behind and the small intestine. In ligation of the vessels, large mass ligatures should be avoided, and, "subse-

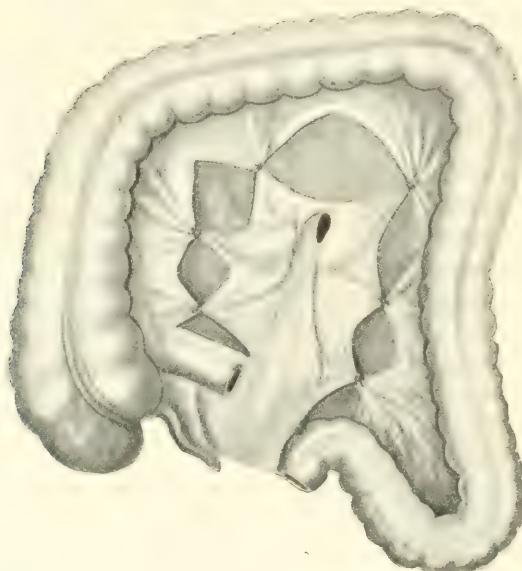


FIG. 45.—Colectomy—shows the method of ligaturing the mesentery of the large bowel. (Lane.)

quently all ligature points should be rendered as inconspicuous as possible" (Fig. 45). One of the operation's chief dangers is hemorrhage, "either from the escape of a vessel from ligature in a fat subject, or from the friability of ligatured vessels in a thin 'toxic' one."

Freeing of adhesions around the splenic flexure from "evolutionary bands," offers the greatest of the technical difficulties. In colectomy the ileum is divided as in ileocolostomy, usually within a few inches of its termination; but should there be much tuberculous ulceration of

<sup>1</sup> Mothersole (British Journal of Surgery, April, 1915, p. 664) reports a series of 10 hemicolectomies, *i. e.*, removal of cecum, ascending colon and part of the transverse colon, with end-to-side anastomosis between ileum and transverse colon, an operation which Lane characterizes as being futile (page 605, same number).

the ileum, or adhesions confining and obstructing it, more or less of this bowel can be removed with safety (Fig. 46). "The surgeon should remember that while only a small proportion of the length of the small intestine is required for health, the longer the small bowel, the greater is the increase in weight of the patient which results from the operation of colectomy."

The pelvic colon is drawn up out of the pelvis and grasped with two pairs of forceps about an inch and a half to two inches above the level of the pelvic brim, so affording a sufficient length of pelvic colon to

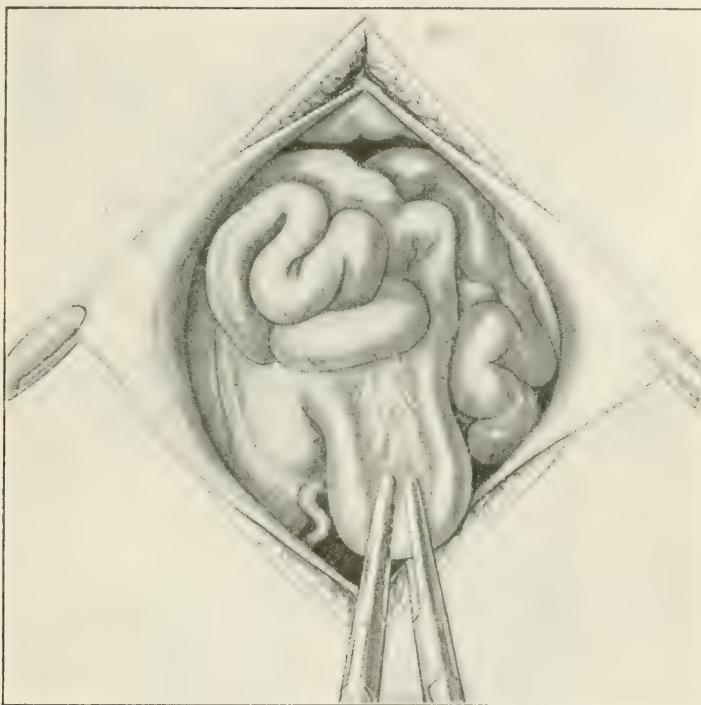


FIG. 46.—Colectomy—showing how the ileum is grasped between two pairs of forceps, preparatory to division, which is done usually by a cautery. (Lane.)

which the end of the ileum can be securely attached (Fig. 47). An end-to-end suture is made. The innermost row is through-and-through, and the outer is a Lembert stitch. Lane says it may be most convenient to secure the adjacent aspect of ileum and colon by a running stitch through the peritoneal and muscular coats (Fig. 48). Then the apertures of the colon and ileum are held apart by means of clip forceps (Fig. 49). The through-and-through sutures are then begun and finished (Figs. 50, 51, and 52). The difficulty of joining two bowels of different calibers is met by arranging sutures so that each picks up a correspondingly greater portion of the pelvic colon than of the ileum.

Much fat in the peritoneal coat is another obstacle to the formation of a perfectly secure junction, but most of this can be removed before

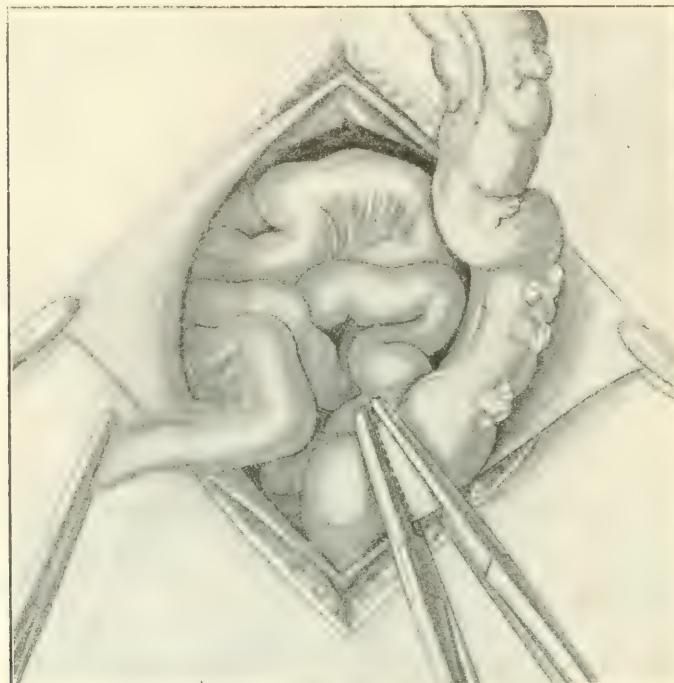


FIG. 47.—The pelvic colon drawn up out of the pelvis and grasped by forceps, for division in a similar way to Fig. 46. (Lane.)

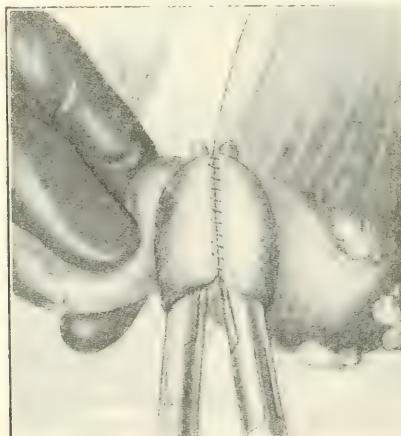


FIG. 48.—The running suture securing the peritoneal and muscular coats. (Lane.)

the anastomosis is commenced. Again, a thickening of the walls of the colon and the reduction of its lumen by inflammatory changes may

render the operation difficult. After the anastomosis has been finished, the cut edges of the mesentery of the ileum and pelvic colon are sutured together, care being taken to leave no raw surface behind on either the upper or the posterior aspect (Fig. 53). A tube is run up the rectum and past the junction, as in ileocolostomy.

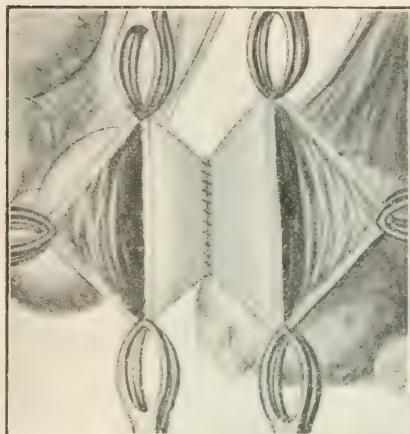


FIG. 49.—The apertures of the ileum and colon held apart by forceps. (Lane.)

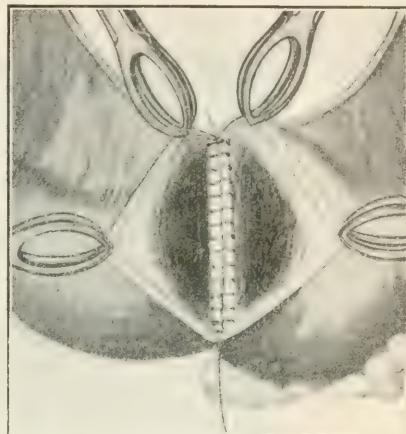


FIG. 50.—Suture joining the adjacent margins of ileum and colon. (Lane.)

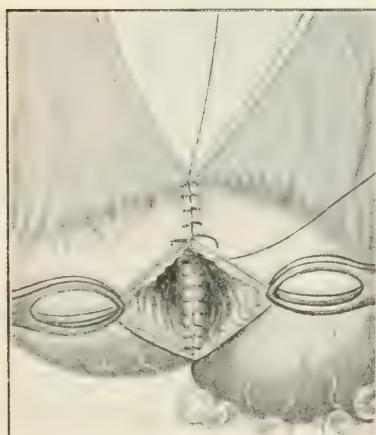


FIG. 51.—Completion of the suture of the bowel. (Lane.)

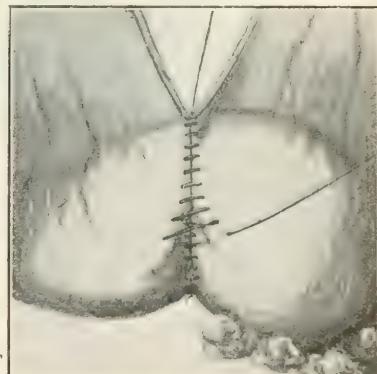


FIG. 52.—Method of inserting the continuous seromuscular suture. (Lane.)

Formerly, Lane used a side-to-side anastomosis between the adjacent ends of the large and small bowel, after closing both ends with purse-string sutures. He found that both ends became much dilated, especially that of the ileum. Later, he employed an end-to-side anastomosis, closing the pelvic colon and implanting the ileum into its side

close to the end, but he occasionally had trouble from obstruction after removal of the tube. Perhaps, as he stated, from some twisting of the bowel at the lower edge. For these reasons he prefers the end-to-end method.

*Appendicostomy for the Relief of Intestinal Stasis.* Patry<sup>1</sup> proposes this as a substitute for the various ileosigmoidostomies and colectomies

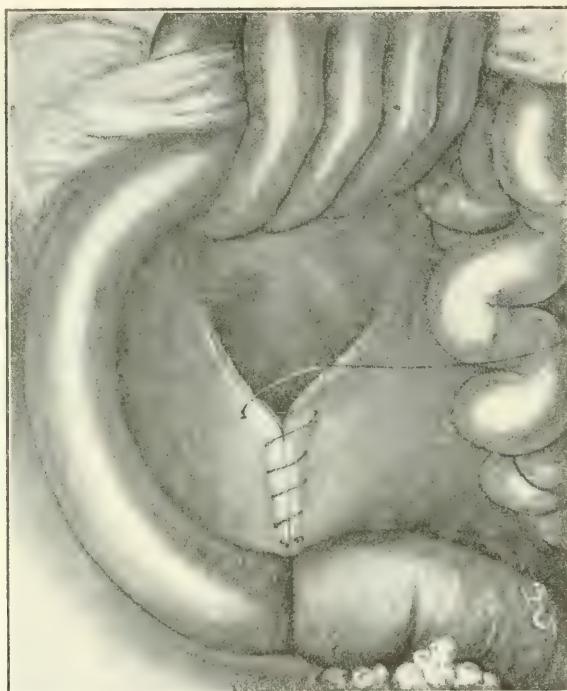


FIG. 53.—Final suture of the mesentery. (Lane.)

so much in vogue at the present time. His patient was a young woman in whom a partial resection of the colon with colopexy had been performed. In spite of this, her severe intestinal stasis continued. Patry established an appendicostomy, through which systematic irrigations were given. Within a short time, daily stools could be obtained. Then the intervals between irrigations were increased until at last only two a week were given. This was kept up for four months. The large intestine was thus trained to perform its normal functions. The fistula finally closed and the patient is now in excellent general condition.

The complete exclusion of the large bowel by means of a (submucous) free fascial transplant combined with ileosigmoidostomy which has

<sup>1</sup> Korrespondenzblatt f. Schweizer Aerzte, 1915, xlv, 897.

been suggested by Strauss<sup>1</sup> is another example of a laboratory invention which is mechanically feasible but impractical in clinical surgery. Strauss's procedure is similar to the Biondi method of pyloric exclusion. There are sufficient instances in the literature to convince anyone that complete exclusion of the intestine in human beings leads to a gradual accumulation of intestinal debris and to ultimate perforation.

RESULTS FROM OPERATIONS PERFORMED FOR RELIEF OF INTESTINAL STASIS. Case<sup>2</sup> has shown that untoward results have been particularly frequent after operations for the relief of intestinal stasis, real or supposed.

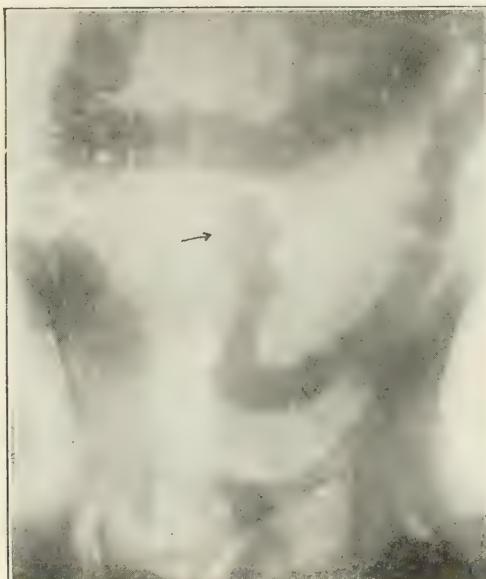


FIG. 54.—Three years after ileosigmoidostomy. The arrow indicates the site of the anastomosis. Appearance of the colon forty-eight hours after barium meal. The colon is filled by material carried backward from the rectum by retrograde peristalsis. This retrogression of food residues often forms large cecal tumors. (Case.)

*Ileocolostomy.* Case observed 40 such cases in which the operation had been performed according to Lane's technic. The series represented the work of more than a dozen different surgeons—most of them of national reputation—in fact, one patient had been operated on by Lane himself, consequently, the unsatisfactory results could hardly be attributed to poor technic.

In most instances there was an apparent cure during the first few months after operation but, sooner or later, usually within a year, the

<sup>1</sup> Journal of American Medical Association, lxvi, 267.

<sup>2</sup> Ibid., lxv, 1628.

old symptoms began to recur and the final condition was much worse than it had ever been before operation. In a few exceptional cases operation seemed to have an immediate magical effect, but here too the original symptoms recurred in due course of time.

Under the fluoroscope the bismuth enema demonstrated that only those patients showed a competent ileocolic stoma in whom an artificial ileocolic valve according to the method of Kellogg<sup>1</sup> had been established. In one case three years after operation, the artificial valve was functioning perfectly and there was no ileal stasis (Fig. 56). Of 12 ileocolic

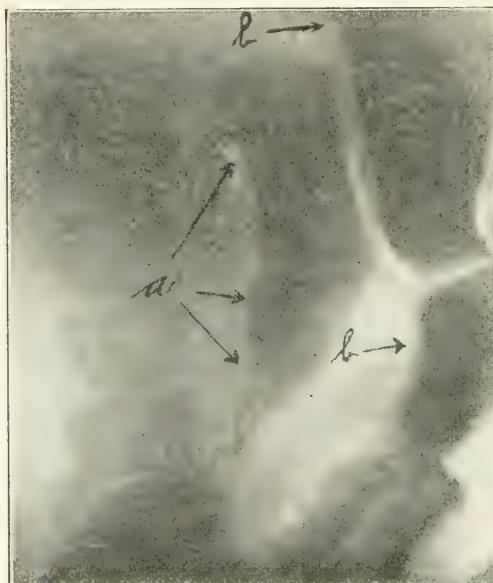


FIG. 55.—Another case two years after ileosigmoidostomy. Colon injection. Note the very marked dilatation of the small bowel shown at *a*, whose caliber equals that of the neighboring colon shown at *b*. There was marked ileal stasis in this case, shown after the barium meal. In cases of ileosigmoidostomy, examined shortly after the operation, there is noted a similar insufficiency of the ileocolic orifice, but the coils of terminal ileum do not exhibit the same degree of dilatation until later. (Case.)

valves established by Kellogg, 7 were found to functionate properly and 5 (occurring early in the series) were failures. On this basis Case considers it advisable to produce an artificial valve whenever an ileocolostomy must be performed. However, as one can see below, he is no advocate of this operation.

In all of the patients with the customary ileocolostomies, according to Lane, the ileocolic stoma permitted the bismuth mass to flow up into

the terminal ileum as well as up along the colon to the cecum or to the stump of the colon where a partial colectomy had been performed (Fig. 54). The ileum close to the anastomosis with the colon was not much enlarged in cases recently operated on, but later—two or three years afterwards—became so dilated that it was impossible in some instances to tell whether the bismuth-filled gut was colon or distended ileum (Fig. 55). Definite ileal stasis was present in most of the cases after the first postoperative year, the degree of the stasis being directly proportionate to the amount of ileal dilatation.



FIG. 56.—In performing the operation of ileosigmoidostomy it is possible to make an artificial valve at the new opening by Kellogg's method. In the case shown here the right half of this colon had been removed and the ileum inserted into the sigmoid with the formation of an artificial valve. The enema failed to enter the ileum. There was no ileal stasis following the bismuth meal. There was marked stasis in the blind portion of the remaining colon; *a*, stump of transverse colon; *b*, site of ileocolic junctio. (Case.)

One cannot help sharing the sound, well-taken opinions expressed in Logan Clendening's polemic against the assertions and practises of the Lane School. In the terms of modern slang, "it was coming to them." Following the barium meal, an invariable retrograde peristalsis carried the barium oralward as far as possible from the rectum. This regurgitation was observed to occur immediately after the mass reached the rectum, and the head of the back of the column usually reached the splenic flexure by the tenth or twelfth hour. The retrograde movement persisted in spite of repeated enemata and in spite of repeated bowel movements (Fig. 54).

Operations in which a kink in the sigmoid just proximal to the ileosigmoidostomy had been made to prevent retrograde filling of the side-tracked colon, only resulted in still greater stasis and greater difficulty in dislodging stagnant material; such kinks but slightly delayed the retrograde peristaltic filling. In short, ileosigmoidostomy for relief of intestinal stasis, especially ileal stasis, gives a worse end-result than if the patient had not been operated on.

Regarding those cases in which the ascending and part of the transverse colon were removed, the same retrogression of colonic contents, with formation of obstinate residue in the blind end of the stump of the colon was demonstrated.

As to cecosigmoidostomy<sup>1</sup> (three cases), there was seen a double procession of food residues, one column travelling up the ascending colon in the normal direction and the other up the descending colon, the two columns tending to meet near the middle of the transverse colon. In a case of Lewald's studied two years after operation (cited by Case), it is stated that the intra-abdominal distress and constipation, while relieved for a time, recurred within two years, and this constipation became extreme. The cecosigmoidostomy seemed to have established a definite vicious circle, only a small amount of the colonic contents passing down into the rectum and being voided.

In cases where the ascending and part of the transverse colon are resected with ileosigmoidostomy close to the resected stump, Case advocates insertion of the ileum into the transverse colon as near as possible to the stump of the large bowel as well as the artificial ileocolic valve of Kellogg, whenever feasible.

Like Case, Coffey has observed that the ileum is always dilated following ileosigmoidostomy whether or not it has been cut off from the cecum. Where the cecum and first half of the transverse colon have been removed, the ileum has been found to be filled with fecal matter as high as three feet from its junction with the colon.<sup>2</sup>

Coffey is in favor of forced feeding rather than operative measures for cases of intestinal stasis. (See also Jones and Brown, cited below.)

Clarke<sup>3</sup> reports that lateral anastomoses between the cecum and the

<sup>1</sup> Eastman advocates typhlosigmoidostomy or typhloproctostomy. He considers this in the nature of a safety valve operation, rather than one which will completely divert the stream. His first x-rays were made while the patients were still in the hospital shortly after operations. The bismuth column did not pass from the cecum through the anastomosis opening. Three weeks after operation it was found that part of the bismuth column after reaching the cecum passed partly through the anastomosis opening, though the greater part arose in the ascending colon as before. The amount of material passing through the stoma into the sigmoid was in direct proportion to the amount of adhesion formation around the large intestine beyond. (Annals of Surgery, March, 1915, p. 334).

<sup>2</sup> Journal of American Medical Association, lxxv, 770.

<sup>3</sup> Pennsylvania Medical Journal, June, 1915.

pendant transverse colon, or between the latter and the sigmoid, do not give successful results. His objections to colectomy are twofold: First, the absence of the omentum adds to the postoperative risk of adhesion formation; secondly, the ileum tends to become dilated and perhaps to lose its functional value.

As a result of his experiences with operations performed for intestinal stasis, comprising less than 10 per cent. of those he had observed with this condition, Ochsner<sup>1</sup> has still further restricted his indications for surgical interference. He states without reservation that this series contained some cases which should not have been treated surgically, as shown by their subsequent condition. In selecting cases for surgical treatment, all neurotic individuals should be eliminated. They are the type that get the "operation habit." Ochsner limits the application of surgery to those patients in whom there is an actual demonstrable cause of obstruction such as tumors, cicatricial contraction or stenosis from marked bands or adhesions. While conceding there is enough of practical value in the subject of stasis to deserve the attention of every clinician, Ochsner points out that "just as the dietician or climatologist can find causal relation between disease of every form and the subject of his especial interest, so can the practitioner who is an enthusiast in the study of intestinal stasis apply his fad."

The clinician should first become thoroughly familiar with the many variations in the normal subject. "By comparing these with his finding in subjects with so-called stasis and with the anatomical condition as demonstrated at operation, he will be more likely to arrive at the truth."

Ochsner's experience covers a period of five years and comprises 36 cases, with 32 recoveries; there were 4 deaths.

Smithies,<sup>2</sup> speaking of short-circuiting operations and partial colectomies, says that "after the latter it is not uncommon to find obstinate and distressing diarrhea associated with abdominal pain or constipation of a degree exceeding that experienced before operation."

Like Ochsner (see elsewhere in this review), Jones finds that less than 10 per cent. of all patients with so-called intestinal stasis reveal conditions which warrant surgical interference. Jones is a strong advocate of the Weir Mitchell rest cure, followed by a long course of physical training and appropriate treatment of the associated psychical disturbances. In one case there was a band across the lower portion of the duodenum which, upon its division, relieved the pain and vomiting associated with duodenal stasis. As a rule, however, the stasis can be overcome by dietetic and postural methods. The overfeeding is started in bed. Contrary to the general rule of small, frequent meals, Jones advocates feeding forced to the limit of endurance with a mixed

<sup>1</sup> Surgery, Gynecology and Obstetrics, January, 1916, p. 44.

<sup>2</sup> Ibid., p. 57.

FIG. 57



FIG. 58



Figs. 57 and 58.—Illustrating the effect of fattening on the position and size of the stomach. Case of a young woman who gained thirty pounds in six weeks. (Jones.)

diet of high caloric contents. During the first week or two of the fattening process there are marked radiographic changes which take place in the abdomen (Figs. 57 and 58). The kidneys, stomach, and transverse colon become in the majority of cases, rapidly elevated and the dilated atonic stomach becomes normally contracted. Occasionally it is noted that the stomach and colon are not elevated, and yet this does not seem to affect the symptomatic cure. Jones<sup>1</sup> emphasizes that a long course of proper physical training, with maintenance of body weight, must follow this initial forced feeding, and that it requires one to two years of adequate body weight, normal bowel function and systematic physical training to produce a permanent end-result. He makes a good point in stating that one must differentiate between the psychically weak or neurasthenic patient, and the physically weak or asthenic patient. In the latter class, as soon as the general nourishment and condition of the body are brought up to a normal, the neurotic symptoms vanish of their own accord, whereas in the former class, psychotherapy is indicated to prevent a recurrence.

Brown<sup>2</sup> is also an advocate of treating visceroptosis by hypernutrition. His regimen, in addition to forced feeding, includes rest in bed, the stomach pad, fresh air, hydrotherapy, massage and occupation.

Bloodgood<sup>3</sup> reported upon the condition of 28 patients after partial or complete resection of the colon. Of these, 16 patients are well. The convalescence is slow and may require two years. After four years' observation of resection in cases of atonic disease, and seven years' observation after resection for local disease, it is evident that removing the right colon does no harm. Seven of the atonic cases were failures. Upon reoperation the failure was found to be due to the use of side-to-side anastomosis. The two blind extremities became tense and painful diverticuli; this did not happen in ulcer or cancer cases. In Bloodgood's last 3 cases, an end-to-end anastomosis had been used in preference to side-to-side. That resection of the right colon had a beneficent effect upon atony, was shown by one case, in which there was vomiting, with food retention in the stomach and stasis in the colon; eighteen months after the operation there was no vomiting, and there was hypermotility of the stomach and colon. Bloodgood believes that this atonic state of the colon is a terminal condition which is preventable by proper medical treatment.

Bland Williams<sup>4</sup> reports 35 cases operated upon for chronic intestinal stasis during the past two years. It is to be noted that in none of these were short-circulating or colectomy indicated. Bands are divided, and all denuded or raw surfaces are thoroughly peritonealized. Unusually mobile ceca are united to the lateral abdominal wall along the

<sup>1</sup> Surgery, Gynecology and Obstetrics, September, 1915, p. 322.

<sup>2</sup> Journal of American Medical Association, lxiv, 1977.

<sup>3</sup> Ibid., lxv, 193.

<sup>4</sup> Annals of Surgery, September, 1915, p. 326.

external taenia. The external taenia is sutured to the lateral abdominal wall by two or three interrupted catgut sutures. Williams, who is connected with the United States Naval Hospital at Norfolk, Va., states that several cases traced for a year and a half have remained in excellent health. He adds, "It may be remarked, that the ability of an enlisted man in the navy to perform his duties on a sea-going ship is a rather severe test as to the character of the results obtained."

*Ileocolostomy and Colectomy for Arthritis Deformans.* For the past two years Rea Smith<sup>1</sup> has followed Arbuthnot Lane's advice in the treatment of arthritis deformans. He reports a series of 18 cases in each of which there was a marked ileal stasis, associated with a dilated prolapsed colon and evidence of colonic stasis. Smith operated upon 14 patients. In 2 a primary partial resection of the colon was done. Of the remaining 12, 1 died shortly after operation; of the others, 5 made good recoveries, and 3 were able to resume their occupation. The remaining 6 had recurrences after a transient improvement. In 1 of these, the röntgenograms showed an eighteen-hour stasis still in the ileum. Smith states that "the portal of entrance of the streptococcus in all the cases of chronic arthritis that I have had an opportunity of studying, is the ileocecal coil, and the stasis in the terminal ileum is the predisposing cause."

One cannot agree with his conclusions. While the portal of entrance may be the ileocecal coil, we do not believe that the demonstration of streptococcus viridans or other of bacteria from the terminal ileum implies infection of that mucous membrane, and, from what we know, not only is the stasis in the terminal ileum not prevented, but it is even aggravated by ileosigmoidostomy or resection of the colon with implantation of the ileum. Consequently, the second conclusion that drainage of the ileum will cure this infection in a large proportion of cases is not proven. Next comes the statement that the colon will have to be removed as well if the cecal walls have become infected. We should like to know what constitutes criteria of infection of the cecal walls. One does not doubt that marked improvement followed the operation of ileocolostomy or colectomy in these arthritis cases, but the pathological explanations for this improvement are extremely unsatisfactory, and, considering the shortness of the time (two years) since the beginning of this series, we feel sure that the supposedly cured cases will return in due time with trouble in their short-circuited colons. We regret that Smith did not publish a pathological report of the infected ileums and colons, and that he omitted to give the dates of operation and case reports of his series.

*Arthritis of various forms treated by ileocolostomy or colectomy.* A consecutive series of 33 cases operated on by Lane himself is reported

<sup>1</sup> Journal of American Medical Association, lxxv, 771.

by Fagge and Hughes.<sup>1</sup> There were 2 operative deaths, 1 from pulmonary embolism on the thirteenth day, and 1 from peritonitis on the twelfth day. Six other cases subsequently died of their original disease or one of its complications. Of 23 patients with tuberculous joint disease, 19 were children and 4 adults. Of 17, but 4 were actually attended for inspection some time after operation. Eight could not be traced. Three were reported by their doctors, and 2 stated their personal impressions of their own condition. In 8, as far as one could judge from the report, the results were satisfactory. There were 3 cases of Still's disease. In 1, *staphylococcus citreus* was found in the blood at the time of pyrexia—during febrile exacerbations of the disease. At the time of ileocolostomy, *staphylococcus citreus* was obtained from the interior of the ileum. A subsequent colectomy was performed. A year later the child was better. A second case showed slight improvement after operation, but the record did not state whether colectomy or ileocolostomy had been done. A third case was readmitted some time after operation for intestinal obstruction which ended fatally. There were 7 cases of multiple arthritis, probably of rheumatoid origin. They did not show great improvement. One cannot consider such results conclusive.

Gilbert Barling<sup>2</sup> reports 4 ileosigmoidostomies for intestinal stasis. The results were not good. One patient was a boy of five years, with Still's disease. Although he made an easy operative recovery, he did not show the slightest improvement.

*Bacterial Activity in the Alimentary Tract* is the title of an article by Nathan Mutch<sup>3</sup> supporting Lane's theories. As in other articles by Lane and his advocates, one cannot doubt the accuracy of observed facts, nor is there much controversy on this point. Disagreements with the Lane school arise from differences in interpretation of pathology and etiology, and, consequently, in the rational therapy of such conditions.

**Observation:** Marked stasis of duodenal contents with the dilatation of the duodenum and stagnation in both duodenum and stomach. Interpreted as due to kinking at the duodenojejunal flexure by reason of the weight of accumulated chyme in the lower ileum (p. 611).

**Observations:** Duodenal stasis intimately associated with ileal stasis. Duodenal stasis and ileal stasis associated with hunger pain of gastric ulcer. (A point of tenderness one and one-half inches above umbilicus in the median line is commonly found in subjects with constipation; this corresponds with the third part of the duodenum which has a constant position, the pylorus being subject to great variations in locality (see "Normal Mobility of Pylorus" elsewhere).

<sup>1</sup> British Journal of Surgery, April, 1915, p. 657.

<sup>2</sup> Ibid., p. 653.

<sup>3</sup> Ibid., p. 608.

A Gram-positive hemolytic streptococcus was obtained in pure culture from the duodenum of a man suffering with severe anemia and a cutaneous pigmentation suggestive of Addison's disease.<sup>1</sup>

In his report upon decomposition in the ileum, Mutch fails to inform us regarding what sort of media were used, and whether the cultures were made anaerobically or aerobically. The bacteriology and physiological chemistry of the work are not convincing.

Observation: Cultures from lower ileum 1 cm. proximal (oral) to the ileocecal valve showed infinitely fewer organisms than those made from the cecum." The contents of the cecum do not usually regurgitate through the ileocecal valve." From these observations it is deduced that not only does the ileocecal valve prevent gross regurgitation, but that it also acts as a very efficient barrier against bacterial invasion of the ileum.

The urine of patients, before and after ileocolostomy or colectomy, was examined for substances due to bacterial decomposition in the alimentary tract. From this it is deduced that the excretion of tyrosin derivatives in the urine is proportional to the degree of coliform infection of the ileum, as also is the excretion of tryptophane derivatives. "Excretion varies directly as the degree of ileal stasis." Elsewhere, "the number of coliform organisms in the ileum is proportional to the degree of ileal stasis." The excretion is almost abolished by "*drainage of the ileum*," even though the colon is left *in situ*, and ileocolostomy alone performed. The reader's attention is called to the fact that others, notably Case and Coffey (just cited), found ileal stasis increased after ileocolostomy, as evidenced by formed fecal matter in the lower coils of the ileum, and that the colon proximal to the site of anastomosis is a blind cul-de-sac in which stasis is assured. Hence improvement in symptoms must be accounted for in some other way than "ileal drainage" or "partial exclusion of the colon."

Mutch says that a marked ileal kink acts as a protective barrier against invasion of the ileum by coliform organisms. Neither Barclay nor Keith consider that bands or kinks obstruct the passage of material forward in the small intestine or in either direction in the large intestine. (See reviews above.) According to Mutch, decomposition in the colon is quite secondary in importance to ileal decomposition.

A case of Still's disease with *staphylococcus citreus* in the ileum (found at colectomy after the ileocolostomy) is then reported. The child had a positive *staphylococcus citreus* blood culture during his febrile periods. Colectomy was performed nine months after ileocolostomy because of fecal accumulation in the partially excluded proximal colon. Two and a half years after operation the child was in excellent

<sup>1</sup> Jones (*Surgery, Gynecology and Obstetrics*, September, 1915, p. 322) calls attention to the striking resemblance between certain pigmented toxic types of so-called intestinal stasis and Addison's disease.

condition, having gained twelve pounds in the last year and a quarter. The enlargement of the lymphatic glands and of the spleen had almost subsided. This case is cited as an instance of chronic intestinal infection with chronic joint changes which were cured by eradication of the primary source of infection. Compare this report with that of Gilbert Barling cited above.

Mutch then discourses upon the tendency of people with intestinal stasis to suffer from coldness of the hands, feet, nose and ears. In this connection a case of Raynaud's disease of nine years' standing is cited. *Streptococcus brevis* was found in the duodenal contents. Following colectomy for chronic intestinal stasis, his hands became quite supple and the clawing disappeared within twenty-four hours. Seven weeks later he was walking freely without a limp. Colectomy restored his hands so that they no longer showed abnormal reaction after exposure to cold (they recovered their temperature promptly).

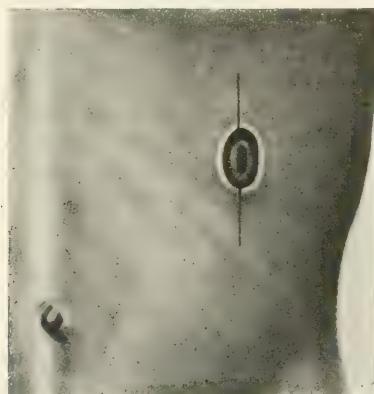


FIG. 59.—Circumeision of fistula at mucocutaneous margin; incision through skin and subcutaneous fat above and below fistula. (Beer.)

**Closure of Mucocutaneous Fecal Fistulæ.** The following method proposed by Edwin Beer<sup>1</sup> is simple and easily carried out under local anesthesia. It has the additional advantage of not invading the peritoneal cavity. The essential principle is to separate the intestinal suture line from the skin by a layer of healthy adipose tissue and in this way to obtain either a primary closure of the opening in the gut, or, in case this does not obtain, to promote a secondary closure by making the resulting sinus an oblique and tortuous one. The technic is as follows:

As shown in Fig. 59, an incision is made through the skin and subcutaneous fat above and below the fecal fistula. Now the fistula itself is circumcised at the mucocutaneous junction and the adjacent intestinal wall is liberated sufficiently to permit passing a layer of turning-in

<sup>1</sup> Annals of Surgery, November, 1915, p. 576.

sutures. In the course of this liberation, care should be taken not to open the peritoneal cavity. These sutures of fine catgut should run transversely to the long axis of the gut so as to increase its lumen at this

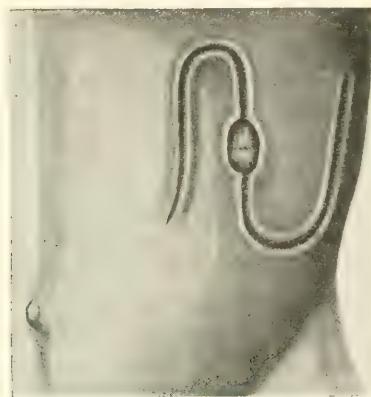


FIG. 60.—Transverse suture of stoma in gut; fashioning of two unequal skin-fat flaps on either side of closed stoma. (Beer.)

point. The gut having been closed, two unequal pedunculated flaps (Fig. 60) are fashioned out of the adjacent skin and subcutaneous tissue. These are transposed so that the broader flap lies over the suture line of the intestine while the narrower flap is then used to cover the area from which the broader flap has been removed (Fig. 61). A few skin

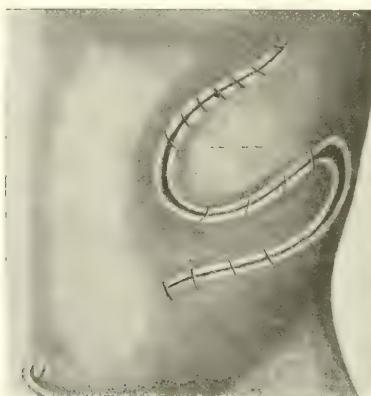


FIG. 61.—Transposition of skin-fat flaps so that broader one covers sutured stoma; attachment of these flaps with few skin sutures in new positions. (Beer.)

sutures hold the flaps in their new position without tension. A piece of rubber dam is introduced just under the lower flap where approximation is not feasible. Some sloughing of the tip or one edge of one

of the flaps usually has taken place in 3 cases in which Beer has successfully used this method.

**The Treatment of Intussusception.** Morison<sup>1</sup> acknowledges that the following procedure has generally been considered the safest: (1) establishment of colostomy; (2) excision of the growth delivered upon the abdominal wall, and (3) closure of the colostomy. Morison remarks that this plan has recently been challenged by Lane who says the whole colon should be removed in these cases. Lane's suggestion appeals to Morison because he is satisfied that the principle of removing a large area of the distended sodden intestine and its septic contents above an acute obstruction in the small intestine—a principle suggested by A. E. Barker—has not received the recognition it deserves. Morison's own experience with obstructions of the small intestine has proved this to be a life-saving measure and he asks why should not the same principle be applicable to obstructions of the large intestine. Morison attempted to carry this into effect in the case of a middle-aged man with obstruction from carcinoma of the sigmoid flexure. The distended colon was the chief cause of the abdominal distention. The course of removal went well until the middle of the transverse colon was reached. Here a leak occurred. This happened several more times before the excision was completed. The patient stood the operation well, but died of peritonitis. In spite of his unfortunate experience, Morison recommends excision of the distended colon with immediate anastomosis of the ileum to the stump of the colon in selected cases.

In those cases in which a colostomy is indicated because of the patient's poor condition, he advocates<sup>2</sup> "drainage by cecostomy because the pressure of the intestinal contents is greater in the cecum than elsewhere, and consequently patchy gangrene of the caput coli may occur wherever else the obstruction in the colon may be situated. Moreover, the cecum is sufficiently movable to be drawn forward with ease, and a cecostomy in the right iliac fossa is well out of the way of subsequent incisions, hence the choice of this part of the colon."

**Chronic Intussusception; INFLAMMATORY INDURATION MISTAKEN FOR CARCINOMA.** Rutherford Morison<sup>3</sup> reports 2 cases of chronic intussusception in which he resected the large intestine. In 1, there was an intussusception of the descending into the iliac colon, apparently from a carcinoma; in the other, it occurred in the ileocecal region. Upon reduction, such a definite firm lump was felt in the head of the cecum that the macroscopic diagnosis of carcinoma was made. In both specimens the microscopic examination revealed a localized swelling produced by hemorrhage and inflammatory effusion.

<sup>1</sup> British Journal of Surgery, October, 1915, p. 330.

<sup>2</sup> Morrison quotes from his contributions to the Edinburgh Medical Journal of July and August, 1904.

<sup>3</sup> British Journal of Surgery, October, 1915, p. 329.

**The Röntgen Findings in Diverticulitis of the Large Intestine.** Before he had acquired any extensive experience with such cases, Carman<sup>1</sup> believed that a filling defect could in many instances be demonstrated, but that such could not be distinguished röntgenologically from a filling defect due to carcinoma. Developments in the following cases led to a change of opinion: In January, 1914, a patient was examined in the routine way by barium enema. The röntgenogram showed an irregular filling defect with marked narrowing in the sigmoid. Small barium shadows were observed outside the lumen of the bowel, an appearance quite unusual, and at that time not explainable. From the clinical facts and the Röntgen appearance, W. J. Mayo



FIG. 62.—Röntgenogram of barium-filled colon (enema), showing marked filling defect in sigmoid with extraluminal shadows (diverticula) at A. (Carman.)

suggested to the patient that the condition might be diverticulitis. Such was found to be the case at subsequent operation with resection. In 2 subsequent cases, similar small shadows (see Figs. 62, 63, and 64) were found.

Still holding to the idea that diverticula could seldom or not at all be visualized, Carman examined the specimen obtained by resection with the idea that the extraluminal shadows might have been caused by calcareous deposits; none were found. The shadows in the röntgenogram corresponded in contour and situation to the larger diverticula present. It is evident that although sigmoid diverticulae are

<sup>1</sup> Annals of Surgery, March, 1915, p. 343.

usually filled with fecal material, in some instances they may be emptied by purgation or a cleansing enema, and, if of sufficient size, may then be filled with part of the bismuth given by enema and so be



FIG. 63.—Shows barium-filled colon (by enema) with extraluminal shadows (diverticula). (Carman.)



FIG. 64.—Colon filled with bariumized enema. Diverticula at A. (Carman.)

visualized under the Röntgen rays. In such a case they appear as rounded or oval barium shadows just outside the intestinal lumen, and this phenomenon seems to be of great value in differentiating the condition from carcinoma. While a carcinoma might show more or less apparent pocketing due to degenerative changes, such pockets would not have the rounded symmetry of diverticulae. In the case of a carcinoma supervening upon a diverticulitis, naturally so exact a diagnosis could not be made. Phleboliths or calcified glands may give shadows resembling those of the barium-filled diverticula. Under palpation, during screen examination it can be seen that the phlebolith or calcified gland shadow does not move with the sigmoid, while a diverticulum follows at a constant distance from the lumen of the barium-filled intestine. If the lower sigmoid is affected, it cannot be shifted about by palpation, hence such a distinction cannot be made. Here a screen or plate examination should precede the administration of the barium enema to eliminate the possibility of phleboliths or calcified glands in this region. In the absence of diverticular shadows by anteroposterior view, this should be supplemented by both screen and plate examinations at various angles of observation and also by stereoscopic röntgenograms.

In all röntgenologic examinations of the large intestine, Carman considers that the opaque ingested meal offers less chance than an enema for detecting abnormal conditions, because as the meal scatters irregularly throughout the bowel, the contour of the lumen is not well shown, and small detached branches of barium may lead to erroneous interpretation. He prefers the liquid enema introduced under some pressure and observed under the screen as it fills the bowel.

**Congenital Stenosis of the Sigmoid.** Sweringen<sup>1</sup> found a narrowing which was six inches long and lay between the sigmoid and the rectum. The pathological report showed this to be a large gut of very small caliber, and not normal sigmoid compressed by an inflammatory mass which was present in the pelvis at the time.

**Multiple Papillomata of the Rectum and Pelvic Colon** in a boy, aged thirteen years, were demonstrated by the sigmoidoscope. Abdominal exploration proved that the growth did not extend higher than the lower portion of the iliac colon.

Acting on the suggestion that the prolonged rest afforded by a colostomy might effect a cure in a similar manner to that brought about by establishment of tracheotomy for cure of multiple papillomata of the larynx, a suggestion made by Mr. Saint, his house surgeon, Morison<sup>2</sup> made a left inguinal colostomy above the upper limit of the papillomatous involvement. All the feces came out through the

<sup>1</sup> Transactions of American Association of Obstetrics and Gynecology, September, 1915.

<sup>2</sup> British Journal of Surgery, October, 1915, p. 335.

colostomy and the diseased bowel was simply irrigated twice a day. Eighteen months later, repeated sigmoidoscopic examination showed no signs of growth. The colostomy was closed and the boy has been well since.

**Prolapse of the Rectum in Children.** Ekehorn's method of treatment is advocated by Tölken.<sup>1</sup> The technic is as follows: Under anesthesia, the prolapse is reduced and held in place with the left index finger inserted into the rectum, and is kept there as a guide. A needle is now inserted alongside the lower part of the sacrum through the soft parts into the rectum under guidance of the finger and brought out through the anus. A heavy silk suture is now inserted into the eye of the needle (evidently a Peaslee needle), and the same procedure is carried out on the other side of the sacrum. The two ends of the suture now are tied over the sacrum. Of 9 cases, 1 was lost track of, and 1 was in very poor condition shortly after the operation. The remaining 7 have been permanently cured.

Ach<sup>2</sup> uses fascia lata for a rather complicated suspension of the rectum and rectovaginal septum to the horizontal ramus of the pubes. He reports 2 cases free from recurrence three years after operation.

The methods described above furnish no better hope of permanent cure than does the method of Moschcowitz (obliteration of the pouch of Douglas by superimposed purse-string sutures described in PROGRESSIVE MEDICINE, June, 1913, p. 148). Some of Moschcowitz's cases have been well for a period of ten years; other surgeons have had similar results.

**Radical Operation for Carcinoma of the Rectum.** At the present time most conservative surgeons in this country are performing the two-stage operation. The details of technic were described in my review of Miles's article last year.<sup>3</sup> It will be remembered that the sigmoid was mobilized, and, after division and inversion of both ends, the lower mobilized part was depressed and a peritoneal diaphragm was reformed over it. At the Mayo Clinic one patient was lost several days after this first operation by a perforation of the closed end of the lower segment beneath the peritoneal diaphragm. To avoid another such accident, a tube is now introduced from below, past the obstructing carcinomatous growth into the segment of intestine above the tumor to prevent retention. The growth is removed from below seven to twelve days later.

Incidentally, it may be well to mention that Kraske operations are no longer done in the reversed Trendelenburg position<sup>4</sup> at the Mayo Clinic. Instead of this, the patient lies face down on the operating

<sup>1</sup> Deutsch. med. Wochnschr., 1915, p. 427, Zent. 381.

<sup>2</sup> Bruns's Beiträge, 1914, xciii, 251.

<sup>3</sup> PROGRESSIVE MEDICINE, pp. 158-172.

<sup>4</sup> Ibid., June, 1913, p. 159, Fig. 97.

table with the legs straight out behind him instead of flexed upon the trunk and dropped down.

Coffey has found that the shock and mortality has been decidedly less when the sigmoid was entirely separated at the first operation. Because of the perforation reported by the Mayos, he has modified the technic as follows:

Before beginning the abdominal operation, a fair-sized rectal tube, with an eye on each side, is passed into the rectum beyond the carcino-



FIG. 65.—Proximal sigmoid wrapped in gauze. Tube is passed up to end of distal sigmoid, where it is fastened by a strong double suture passed through the intestine and eyes of tube and tied. When the intestine is held by two forceps and traction is made on the tube, inversion is produced. Note the ends of the severed superior hemorrhoidal artery. (Coffey )

matous growth in order to allow the contents of the sigmoid and rectum above the growth to drain while the operation proceeds.<sup>1</sup> The sigmoid is mobilized by cutting the peritoneum on each side of it. After division and inversion of both cut ends of the sigmoid, all fat and other tissues attached to the distal stump are trimmed away so as to keep its bulk as small as possible. The rectal tube is then pushed up to

<sup>1</sup> It may be remarked that the passage of such a tube should be done only by an experienced person. The carcinomatous rectum has been perforated by the careless or rough manipulation of tubes or bougies.—REVIEWER.

the upper end of the distal segment and a very strong double thread passed through the intestinal wall, through the eye of the rectal tube and out on the other side of the line of suture, the tube thereby being fastened to the sutured end of the gut from its inside. This section is again painted over with iodine for most of its length, its walls are grasped on each side by forceps (Fig. 65) while traction is made on the rectal tube from below. This inverts the large intestine down to the forceps which hold it on either side. Another bite, lower down, is again taken



FIG. 66.—After the distal sigmoid has been inverted and drawn out through the anus, the inverted end is closed by three or four interrupted catgut sutures, and a continuous catgut suture is run along the mesosigmoid, covering the raw fat edges in the peritoneum from the proximal sigmoid to the bottom of the cul-de-sac. (Coffey.)

by the forceps, and the intestine still further inverted. The tube is then pulled down as far as possible, so that the end of the sigmoid protrudes through the rectum; the peritoneal funnel above is closed by two of three catgut sutures (Fig. 66). The superior hemorrhoidal artery, which runs in the mesentery of the sigmoid, is doubly ligated and severed between the ligatures. The peritoneal diaphragm is then closed over by a continuous suture. In women, such a line of suture is strengthened by utilizing the uterus and broad ligament, making the rectum still more extraperitoneal. The rest of the operation is completed in the

typical manner. In 4 of the 8 cases occurring during the past year, Coffey<sup>1</sup> ligated both iliac arteries, but doubts whether this has many advantages. The second operation, twelve to twenty days after the first, consisted in removing the coccyx and last sacral vertebra, and a radical excision of the entire rectum together with its surrounding tissue and fat, and also the sphincter. At this time the second operation produced practically no shock, and might almost be considered a minor operation. The second stage of the operation was considered particularly suited to spinal anesthesia or to gas anesthesia.

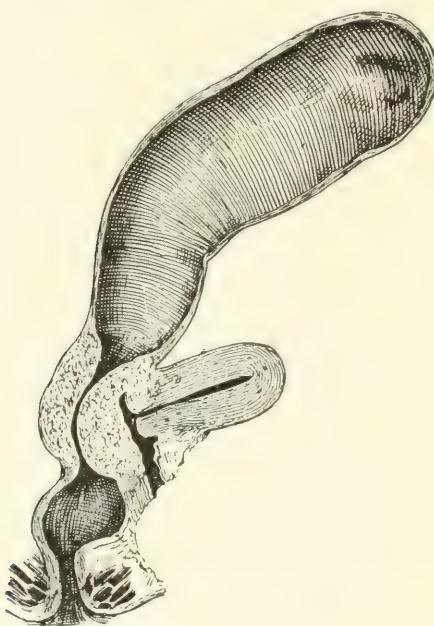


FIG. 67.—Dilatation of the blind lower segment of the large intestine due to obstruction by carcinoma. (Morison.)

While such inversion of the distal stump is most desirable, its feasibility in every case may be questioned. Pulling the inverted end of the lower bowel through the carcinomatous stricture may not be possible without the employment of too much force. In such a case, one must be satisfied with simple drainage of the bowel, as practised by the Mayos at their clinic, if a patient waiting for his second stage begins to show accelerated pulse and his condition becomes unsatisfactory, the second stage is performed as early as the fourth or fifth day.

An illustrative case of retention in the blind lower segment of the large bowel from obstruction by a carcinoma, is cited by Rutherford

<sup>1</sup> Annals of Surgery, April, 1915, p. 446.

Morison.<sup>1</sup> The patient was a women, aged sixty-three years. An inguinal colostomy had been performed by another surgeon; the sigmoid had been divided; its upper end had been used to establish the colostomy; the lower end had been closed and dropped back into the abdomen. In the course of a few months, trouble developed because there was insufficient escape for the putrid rectal contents locked up by the growth below and the operative closure above (Fig. 67). Accordingly, Morison removed the rectum with the growth, together with the uterus and upper vagina. Four years later the patient was perfectly well, without any sign of recurrence.

Carl Davis,<sup>2</sup> in a critical review of the literature, found that while the Kraske type of operation gave 15 per cent. immediate mortality plus 68 per cent. recurrence, or a total of 83 per cent. dying from cancer; the complete operation gave a higher operative mortality, but a much lower percentage of recurrences and a much lower total (55 per cent.) of deaths from operation and recurrence.

**A Direct Vision Cystoscope instead of a Proctoscope** is recommended by Stanton.<sup>3</sup> The rectum is dilated with water instead of air. This method is reported to give a clearer view than that afforded by the customary proctoscopic examination with air dilatation. The cystoscope dilates the sphincter less than the proctoscope and thus lessens the patient's discomfort.

#### THE LIVER AND BILE PASSAGES

**Recurrence in Gall-stone Disease.** In previous years discussions about this subject have centred mainly upon the surgeon's failure to remove gall-stones at the primary operation, and the necessity of maintaining postoperative drainage long enough to permit complete subsidence of whatever degree of cholangitis existed. In many of these cases the history will show that while symptoms have lessened, they have never completely subsided.

There is another group of cases in which for several months or a year after operation there is absolute freedom from trouble. In these, a cholecystectomy for cholelithiasis, together with a thorough exploration of the common duct is performed. No stones are found except in the gall-bladder. Convalescence is uneventful, and the patients are apparently cured. In due course of time, typical gall-stone colics recur, now accompanied by jaundice. At a second operation the common

<sup>1</sup> British Journal of Surgery, October, 1915, p. 337.

<sup>2</sup> Surgery, Gynecology and Obstetrics, October, 1915, p. 497.

<sup>3</sup> Journal of American Medical Association, lxiv, 1154.

bile duct is exposed and opened. Instead of revealing one or more common duct stones, as expected, some bile, in which cholesterol crystals are floating, escapes, and perhaps a little bile sand. There is no obstruction at the papilla to the passage of a sound. There is no cholangitis. Apparently the temporary impaction of bile sand at the papilla gave rise to the attacks of colic and jaundice. Up to the present time, in such cases, all the surgeon could do was to establish prolonged drainage of the common bile duct. All he could say was that the patient had an inherent tendency to formation of biliary sand, the correction of which was beyond his control.

In still other cases of this class the common duct is opened, contains clear bile and exploration with the probe demonstrates a practically normal condition of the papilla and the bile duct. Here the surgeon must assume, but cannot prove, that a stone was present, caused the attack, and has been passed into the bowel. He probably blames himself for failure to discover it at the primary operation.

The writer has operated on three such cases within the past two years, the last one over one year ago. It was his good fortune to have the metabolism of this last patient investigated by M. A. Rothschild after operation. The patient was observed during an uneventful convalescence and from time to time after leaving the hospital. Repeated examinations revealed a steadily increasing concentration of cholesterol in the blood. To control this tendency, Rothschild<sup>1</sup> put the patient on a strict diet, poor in lipoids. The hypercholesterinemic tendency was controlled; the patient has remained free from gall-stone attacks. This dietary method of preventing undue concentration of the cholesterol in the blood and bile was based on Aschoff's theory of gall-stone formation. This theory has received fairly strong confirmation and amplification from other sources. It may be stated in a few words as follows:

Certain individuals have a distinct cholesterol diathesis just as certain others have a gouty (uric acid) diathesis. Persons with this tendency, even upon an ordinary diet, retain their lipoids; there is an increased cholesterol content of the blood and a saturation of the bile with cholesterol. Sooner or later there occurs a sudden precipitation of the cholesterol in the bile in the form of gall-stones. (At the time of precipitation there is often an attack of gall-stone colic *without fever*. Such precipitation is immediately followed by diminution in the cholesterol-content of the blood, often to the normal percentage or even below it. Then a gradual reaccumulation begins, ending, in due course of time, with another cholesterol "shower."

If the stones are small enough to be passed into the gut, there will

<sup>1</sup> Am. Jour. Med. Sci., 1916.

be no more trouble until a new accumulation and precipitation takes place. If the stones are larger, and have not been passed, the chances for frequent attacks are increased. In support of his theory, Aschoff adduced the following frequently observed conditions: A gall-bladder, which showed a single cholesterin stone blocking the mouth of the cystic duct. This stone was not faceted, but was rounded, and consisted of pure cholesterin. Upon transverse section, there was no layering, presumptive evidence that it was the product of but one period of precipitation. In some instances the gall-bladder above such a stone was empty; in others, it was filled with faceted stones of a different character from the solitary rounded cholesterin stone blocking the cystic duct. Such stones were faceted, showed layering on section, and were composed of bile pigment and salts, as well as some cholesterin. They represented the products of inflammation superadded to cholesterin concentration, while the pure cholesterin stone was considered the result of concentration alone. Often the walls of gall-bladders containing single cholesterin stones failed to show the slightest evidence of existing or preexisting inflammatory changes (Aschoff also points out that the first attack of gall-stone colic is rarely febrile).

Rothschild has shown that the cholesterin contents of blood and bile depend on the type of food upon which animals subsist. Herbivora eat material poor in cholesterin; their blood shows relatively small quantities of it. Carnivora and omnivora (man) live upon material richer in cholesterin, and their blood and bile show correspondingly higher quantities. In other words, the amount of cholesterin in the blood depends upon the amount of cholesterin in the food. As just said, there are certain individuals who, under identical conditions of nutrition, have a stronger tendency to retain their cholesterin than is normally the case. In short, their blood shows a hypercholesterinemia.

To digress for a moment, the relation of hypercholesterinemia to gall-stones is only one aspect of a many-sided problem. Hypercholesterinemia is present in physiological, as well as pathological, conditions, as shown by the appended table.<sup>1</sup> The supposition is that stones are first deposited as a result of error in metabolism (overconcentration of cholesterin in blood and bile), and that their presence in a gall-bladder favors subsequent infection. The pigmented layer stones are the result of overconcentration of bile plus inflammation of the bile passages.

<sup>1</sup> Aschoff explains the finding of gall-bladders filled with pigment stones, but with no solitary cholesterin stone, by stating that the latter has been passed.

Rothschild's diet for patients having a hypercholesterinemia is as follows:

HYPERCHOLESTERINEMIA. (After Rothschild.)<sup>1</sup>

<i>Physiological.</i>	<i>Pathological.</i>
Pregnancy.	Jaundice.
Lactation.	Obstructive cholelithiasis (of common duct).
Dietetic (excessive amounts of):	
Eggs.	Diathetic, <i>i. e.</i> , on ordinary diet.
Milk.	Early inanition.
Fish roe.	Arteriosclerosis (non-syphilitic).
Brain.	Chronic nephritis.
Meats (especially fat meats).	Diabetes.
Fish (especially fat).	
Legumes, <i>i. e.</i> , peas, beans, lentils.	

Eggs, cream, butter (all fats), meat and fish are forbidden.

All vegetables (except beans, peas and lentils) are allowed; likewise cereals and sugar, skimmed milk and fat-free buttermilk.

According to Rothschild, this diet is so strict that the majority of patients refused to maintain it for a long period. He therefore devised "feast and fast days." For three or four days a week the patient lives on a strict lipoid-free diet—the so-called fasting period. For the next three or four days, a more liberal diet is permitted—the so-called feasting period. During this time, in addition to the articles allowed in the fasting period, well-cooked lean meat and fish (excluding salmon, shad and blue fish) are permitted. Oleomargarine is given in place of butter.

The tolerance of the individual should be determined from time to time, as is customary in ascertaining the sugar tolerance in diabetes. In this way, the diet may be intelligently regulated.

With this regimen Rothschild was able to reduce the cholesterol in the blood from 0.33 per cent. to 0.233 per cent. within fourteen days (the normal is 0.16 per cent. to 0.18 per cent.)

Unless he has had an adequate training in physiological chemistry, or has learned the method in a laboratory, the surgeon cannot make these examinations for himself. It is unnecessary to enter into the technical details of estimating the cholesterol percentage. Let it suffice that but 2 c.c. are required by the physiological chemist for his examination. The blood can be obtained by pricking the finger or lobe of the ear, as in making the ordinary blood count; it unnecessary to tap a vein. At first the examinations are made every two weeks, later, at longer intervals. The laboratory report can be obtained within twenty-four hours after the specimen has been received.<sup>2</sup>

<sup>1</sup> Medak and Pribram (Berl. klin. Wehnschr., 1915, pp. 706-740) hold similar views to those of Rothschild regarding the conditions in which hypercholesterinemia is present.

<sup>2</sup> Some authors make their estimates in three hours.

For further details about the subject of the relationship of gall-stone formation to hypercholesterinemia, the reader is referred to the writings of Rothschild.<sup>1</sup>

In the light of our present knowledge, it would seem advisable that, a month or so after operation for gall-stones, the blood should be examined for its cholesterol-content, and again, from time to time. In this way an increasing hypercholesterinemia can be recognized, and the reformation of calculi prevented by the simple dietary measures outlined above.

Given a case in which this has not been done, and in which symptoms have recurred, the surgeon must bear in mind the following fact, namely, that the absence of a hypercholesterinemia does not mean the absence of gall-stones. Stones are often present in patients with no excess of cholesterol in their blood—the cholesterol shower having occurred at some previous time. In the absence of acute inflammatory symptoms or obstructive jaundice, the surgeon may safely wait and observe the subsequent course of the case. If the passing of bile sand through the papilla has been the cause of symptoms, there will be no further attack provided the patient is prevented from becoming hypercholesterinemic. If, in spite of a low cholesterol-content of the blood, the symptoms persist and attacks are frequent, it is safe to presume the existence of common duct stones which are too large to be passed and which must be removed by operative measures. In short, patients having stones too large to be passed will not be cured of their symptoms by the control of their hypercholesterinemia. If, on the other hand, the bile passages are free, reformation of stones can be prevented by dietary measures.<sup>2</sup>

**The X-ray Diagnosis of Gall-stone Disease.** Caldwell<sup>3</sup> protests against the indiscriminate and inaccurate diagnosing of gall-stones by means of the *x*-rays. He believes that not more than one-tenth of the cases with gall-stones give perfectly definite reliable *x*-ray shadows of these stones. "In the other nine-tenths (of the cases examined), some of the *x*-ray plates will show hazy and suspicious shadows, many of which are due to gall-stones. If we consider all of these hazy and suspicious shadows corroborative evidence of gall-stones, operation will vindicate us in the majority of the cases and we may easily overestimate the help actually obtained from the *x*-ray plate. Again, I think that the absence of gall-stones cannot, at the present time, be demonstrated with a reasonable degree of safety."

A similar opinion is expressed by Deaver<sup>4</sup> as follows: "The *x*-rays

<sup>1</sup> Journal of American Medical Association, xix.

<sup>2</sup> A persistently high cholesterol content in spite of a strict diet, strongly suggests common duct obstruction, especially if there are attacks of pain. The absence of jaundice proves nothing.—REVIEWER.

<sup>3</sup> American Journal of Röntgenology, November, 1915, p. 816.

<sup>4</sup> Annals of Surgery, August, 1915, p. 203.

in diagnosis are dangerous not only because they fail to show a large percentage of stones, but because they emphasize the importance of the calculous element of the disease, and, if allowed to stand as an indicator for operation, will deprive many of the early treatment which alone is safe and efficacious."

*A curious Röntgen observation* was made by Carman in which perforation of a dense carcinomatous mass surrounding the gall-bladder and involving the stomach, permitted the röntgenological demonstration of a barium-filled gall-bladder in a living patient, (Fig. 68). The perforation was in the anterior wall of the first portion of the duodenum. A dense carcinomatous mass surrounded the gall-bladder and involved the stomach. The patient died the day after laparotomy.



FIG. 68.—Röntgenogram: *A*, carcinoma, pyloric end of stomach; *B*, duodenum; *C*, *B.*, barium in gallbladder; *C*, barium in hepatic duct. (Carman.)

**Situs Viscerum Inversus with Gall-stones.** Horn<sup>1</sup> reports a case with pain in the left hypochondrium in which the dextro position of the heart gave the keynote to diagnosis. To this, he adds 6 cases from the literature.

**Papillomata of the Gall-bladder.** Irwin and MacCarty,<sup>2</sup> report a series of 85 cases found in a series of 2168 gall-bladders removed at operation between January 1, 1907, and January 3, 1915.<sup>3</sup>

<sup>1</sup> Annals of Surgery, October, 1915, p. 423.

<sup>2</sup> Ibid., June, 1915, p. 725.

<sup>3</sup> C. H. Mayo, before the American Surgical Association, June, 1915, reported 107 cases among 2538 cholecectomies. (Annals of Surgery, August, 1915, p. 195.)

In all cases the mucosa was intact. The papillomata varied from twice to five or six times the length of normal villi. They were usually pedunculated, frequently racemose, and generally white or yellow. They were found in any portion of the organ. Upon microscopic section they appeared to be hypertrophic villi, the tissue elements of which presented a hyperplastic condition. They occurred in all forms of inflammation and in the presence of carcinoma elsewhere in the organ; also with and without the presence of stones. (Figs. 69 and 70.)



FIG. 69

FIGS. 69 and 70.—Papillomata of the gall-bladder. (Irwin and MacCarty.)



FIG. 70

**A Calcified Lymph Node Producing Symptoms of Gall-stone Disease** is reported by Cullen.<sup>1</sup> The calcified lymph gland was imbedded in adhesions and was lying against the cystic and common bile ducts (Cullen). (Fig. 71.)

**Benign Tumors of the Stump of the Cystic Duct following Cholecystectomy** were twice found by W. J. Mayo.<sup>2</sup> Both tumors were true fibro-adenoma, nearly the size of a hazel-nut, and were well

<sup>1</sup> Surgery, Gynecology and Obstetrics, March, 1915, p. 260.

<sup>2</sup> Ibid., January, 1916, p. 2.

encapsulated. They caused typical symptoms of common duct obstruction with colic fever and exacerbations of jaundice. Both patients were cured by removal of the tumor and stump of the cystic duct (Fig. 72).

**Cholecystectomy by the Retrograde Method** has gained favor with an increasing number of surgeons during the past few years. In the course of removal, the chief dangers to be encountered are, hemorrhage from the cystic artery, and division or ligation of the common bile duct. W. J. Mayo,<sup>1</sup> in his article on restoration of the bile passages (see below), describes the anatomy of the region as follows:

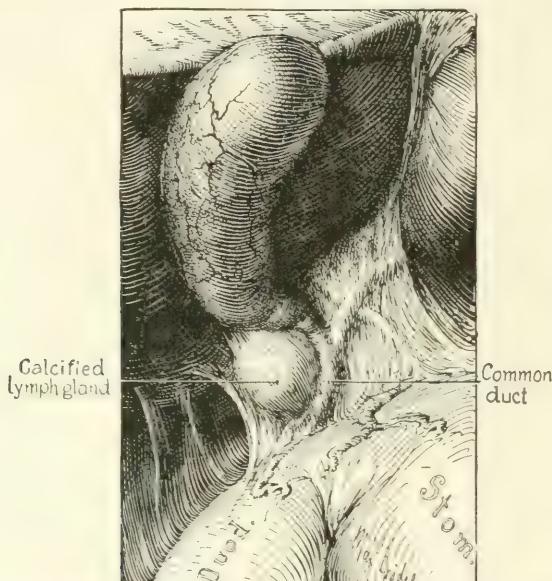


FIG. 71.—A calcified lymph gland embedded in adhesions and lying against the cystic and common bile ducts.

The point of union of the cystic and hepatic ducts is subject to wide variation. It may be found anywhere between the liver and the duodenum. The normal situation is about three-quarters of an inch from the intrahepatic portion of the hepatic duct. When the point of union is low, the cystic duct especially lies parallel and adjacent to the hepatic duct. A careful separation of the two ducts in the course of a cholecystectomy is indispensable to avoid the possibility of severing the hepatic duct. The cystic duct leaves the gall-bladder at a point on the posterior wall a little above the very bottom of the lowermost bulge of the gall-bladder. Consequently, this bulge or pelvis overlaps the cystic and

<sup>1</sup> Surgery, Gynecology and Obstetrics, January, 1916, p. 1.

common ducts and hence, must be freed and drawn upward to expose the underlying ducts. Very frequently there is a little fold of peritoneum connecting this pelvis of the gall-bladder with the gastrohepatic ligament over the common duct. This fold of peritoneum covers and obscures the transition between the lowermost part of the



FIG. 72.—Adenofibroma of the stump of the cystic duct after cholecystectomy, causing common-duct obstruction. (Mayo.)

wall of the gall-bladder and the common or hepatic duct in the gastrohepatic ligament. When the bottom most part of the gall-bladder is seized with a forceps and drawn upward, this fold stands out, raising with it the gastrohepatic ligament, giving the misleading impression that the common duct is merely the cystic duct. To avoid this mistake,

it is essential to grasp the lowermost part of the gall-bladder with a forceps, to draw it upward (Fig. 73), divide the peritoneum and free the structures which it covers until the cystic duct is fully exposed. (See below). The cystic artery is shorter than the duct and lies on a



FIG. 73.—Relation of gall-bladder to cystic, hepatic, and common ducts. Note cystic duct lying on the inner side and overlapped by the pelvis of the gall-bladder, which is shown drawn upward by the forceps. (Mayo.)

plane closer to the liver. It sometimes happens that the duct is securely grasped without catching the artery, and that, when the tissues are divided, the artery quickly reflects and bleeds freely. Hurried attempts to catch the artery with heavy rat-tooth forceps may result in incalculable injury. In such an emergency, Mayo places the forefinger

upon the bleeding point, which is in the bottom of this small extra-peritoneal triangle. With the finger held in place, a few forceps are attached to the tissues around the forefinger forming a little basket. These are now gently drawn upon, and, lifting up the tissues, the finger is removed, and the artery can be caught with exactitude.

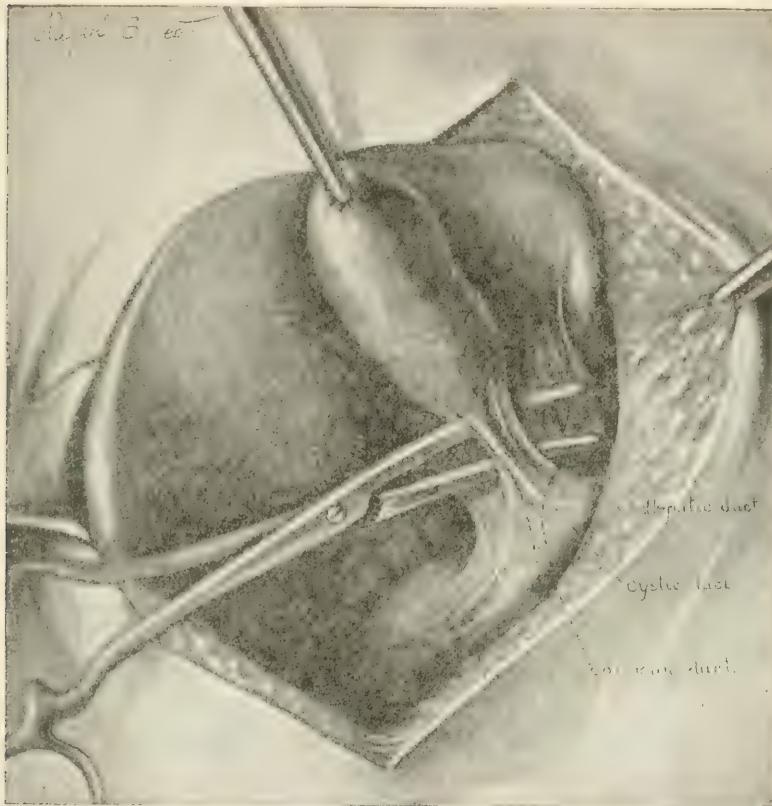


FIG. 74.—High abdominal incision extending to ensiform if necessary. Grasping gall-bladder fundus in soft clamps, the liver is rolled out in the usual way. An additional clamp may be put on the gall-bladder near the cystic duct to tract the gall-bladder and cystic duct away from the liver (Fig. 52), so that by blunt dissection the cystic duct and artery are separated from the surrounding tissue. (Judd.)

*The technic of retrograde cholecystectomy* is described by Judd<sup>1</sup> who points out the advantage of controlling hemorrhage from the beginning:

Step 1. The abdominal incision is made high—usually extending to the ensiform and rather close to the median line. (It may be remarked that the average abdominal incision at the Mayo clinic is one or two inches longer than one is accustomed to see elsewhere; this makes for

<sup>1</sup> Annals of Surgery, lxi, 306.

a good exposure of deeply situated structures). Through this long, high incision the right lobe of the liver is pulled upward and outward (should the liver be adherent to the parietal peritoneum, it is freed before attempting this partial luxation), an assistant catches the fundus of the gall-bladder with a forceps and holds the luxated liver in its new position by retracting upon the gall-bladder (Fig. 74).

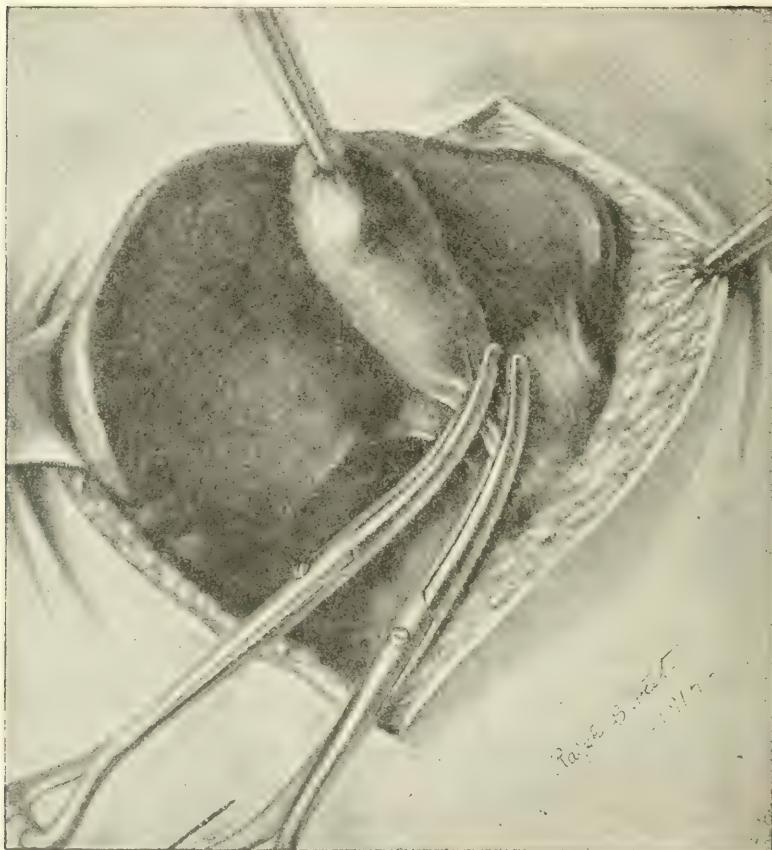


FIG. 75.—Isolated cystic duct with vessels is clamped away from common duct. (Judd.)

Step 2. The neck of the gall-bladder is then caught with a second pair of forceps (Fig. 73), and this part of the gall-bladder and the cystic duct are pulled away from the surface of the liver. Considerable fat and edematous tissue may be encountered in this region, especially if there is an empyema of the gall-bladder; but this fatty tissue can be cleared away from the duct by blunt dissection. Tracing down the cystic duct as a guide (and exerting traction upon the forceps which is holding the neck of the gall-bladder) the common duct is usually

exposed. As said before, it is most important to realize that the neck of the gall-bladder and the lowest part of the body of the gall-bladder frequently overlie the cystic and common ducts, so that only when this lowermost bulging of the gall-bladder is dissected out and pulled upward, do the cystic duct and its junction with the common duct become properly exposed. Now, by exerting traction and with a little

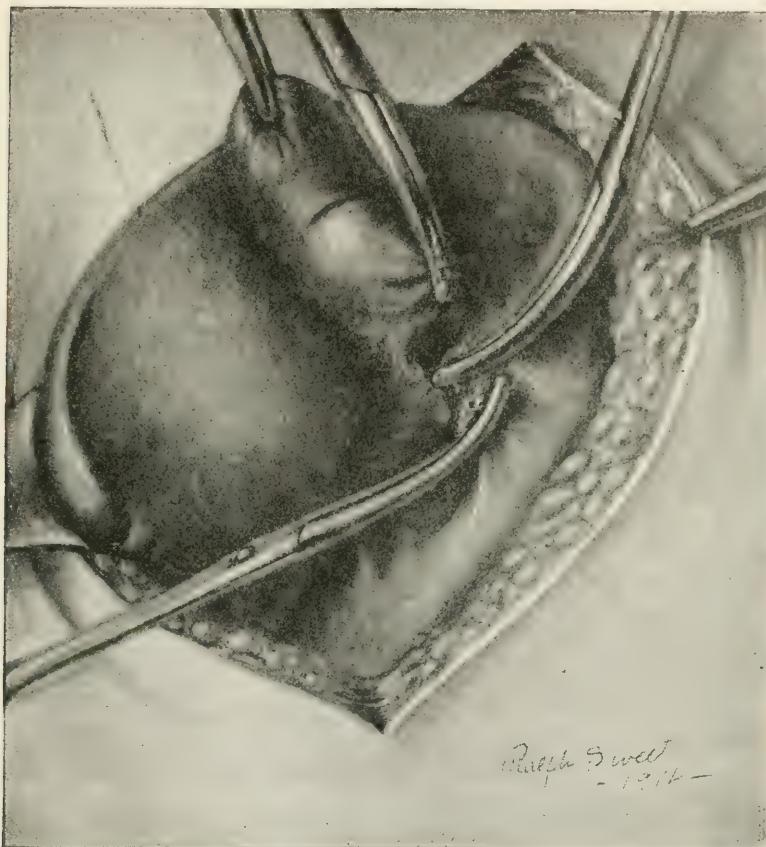


FIG. 76.—Cystic duct severed between clamps. Gall-bladder turned out. One clamp under the cut-off end of the gall-bladder catches any little vessels not included in the clamp on the cystic duct. (Judd.)

blunt dissection, the cystic duct is easily separated from the surface of the liver (Figs. 73, 74, and 75.)

Step 3. The cystic duct and cystic artery are kept together after they are completely freed from the surrounding tissues for the distance of half an inch to an inch, they are caught together in two clamps and divided between the clamps. (Figs. 75 and 76). If the dissection is properly carried out, Judd insists that the cystic artery can be definitely

ligated without tension and that the common duct cannot be injured because the forceps includes nothing but the cystic duct and artery.

Step 4. After dividing the duct and vessels between clamps, the clamp holding the cut end of the gall-bladder is pulled upward with a



FIG. 77.—Gall-bladder dissected out in the usual way and fissure in the liver sutured.  
(Judd.)

little tension, thus exposing the peritoneal fold and communicating vessels at this point. These vessels are caught and the gall-bladder dissected a little way up from its attachment to the liver (Fig. 76).

Step 5. The stumps of the cystic duct and cystic artery are now ligated with one ligature of plain catgut, the ends of the ligature are

immediately cut and the stumps are allowed to drop back free from the liver. A suture is then started through the cut edges of the peritoneal folds from which the neck of the gall-bladder has been removed. The gall-bladder is removed a little at a time, just preceding this suture line. This suture is continued upward to the edge of the liver so as to cover in the raw surface left by removal of the gall-bladder. (Fig. 77). In this way, the gall-bladder is used as a tractor for as long a time as pos-

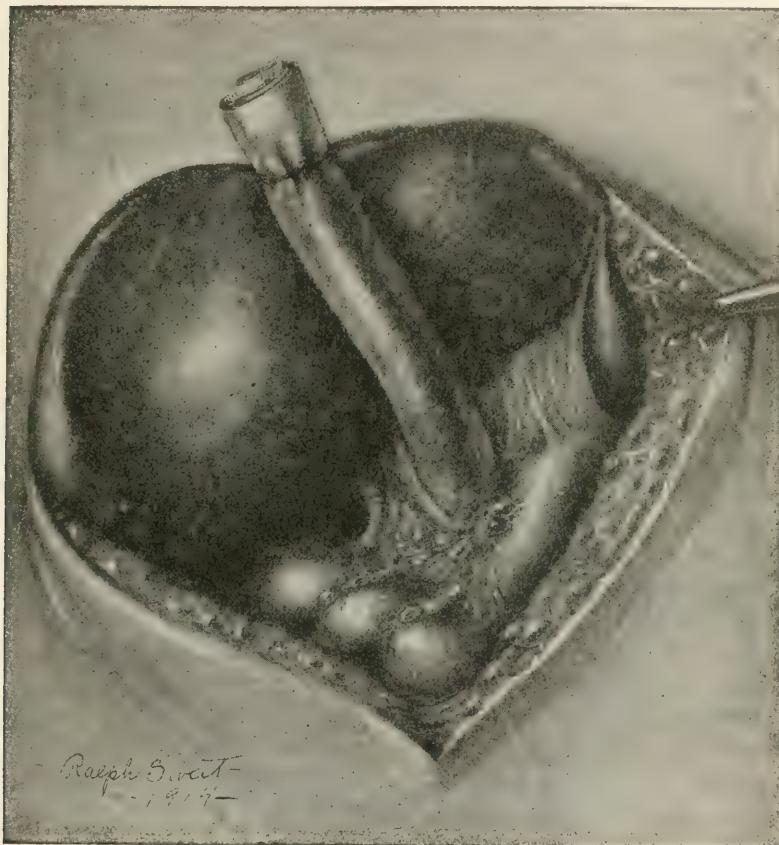


FIG. 78.—Drain down to cystic duct. (Judd.)

sible. Oozing from the surface of the liver is usually controlled by a little pressure, and perhaps relaxation of tension or one or two extra stitches.

Step 6. A small cigarette drain is placed down to the cystic duct and brought out so it will lie in the fissure from which the gall-bladder was removed (Fig. 78). For this purpose a split rubber tube with gauze in it is usually employed.

From personal observation at the Mayo clinic the reviewer considers that the large incision plus traction upon the deepest part of the gall-bladder which can be identified as such, and the use of this structure as a tractor after division and ligation of the cystic duct are the most essential mechanical features.

In the absence of acute inflammation, this retrograde removal of the gall-bladder is nearly always possible. In the acute suppurations, however, it may often be less difficult to shell out the gall-bladder working from the edge of the liver downward. One must suit available methods to the exigencies of the individual case.

**Restoration of the Bile Passage after Serious Injury to the Common or Hepatic Duct.** Various methods for accomplishing this are described by W. J. Mayo<sup>1</sup> who says that the majority of injuries to the common and hepatic ducts are the result of various operative accidents.<sup>2</sup> As a rule these are not discovered until attention is called to them by the development of jaundice, a permanent biliary fistula, or other symptoms of obstruction. In a small minority the obstruction is due to stricture following ulceration from stones. According to Mayo, these strictures are most frequently found in that portion of the common duct fixed in the head of the pancreas.

The poor condition of the patient, the extensive adhesions and consequent oozing, plus the difficulty in technic, adds to the gravity of operations for restoration of the bile passages. The incision should be made close to the midline, usually not more than two inches to the outer side, because the cystic and common ducts lie very close to the median line. Mayo prefers Bevan's incision; it begins at the ensiform cartilage, extends directly downward for one and one-half inches, and divides the upper half of the right rectus muscle on a line with the costal margin and about one inch from it. The longitudinal part of the incision should be kept inside the incision of the previous operation. All bleeding vessels situated in the subcutaneous tissues of the skin must be tied. They have a strong tendency to bleed after operation even when they are quite small. The vessels in the muscles have less tendency to bleed after temporary clamping. The duodenum and stomach will often be found adherent to the gall-bladder notch, thus completely overlying the common duct. Adhesions are divided and ligated, rather than separated bluntly. In the course of time the foramen of Winslow is cleared and the second portion of the duodenum, if overlying the strictured area, is dissected free from its position. From now on one of the following procedures will be carried out depending on the type of previous injury.

<sup>1</sup> Surgery, Gynecology and Obstetrics, January, 1916, p. 1.

<sup>2</sup> The anatomical factors which predispose to inadvertent mechanical injury to the bile passages during the course of a cholecystectomy have been mentioned in describing retrograde cholecystectomy above.

EXCISION OR RESECTION OF OBSTRUCTED PORTION OF COMMON DUCT WITH END-TO-END UNION. The hepatic duct is identified either by its bulging end, if completely ligated, or by the biliary fistula leading down to it. Mayo says it is surprising how easily the common duct may be found by simply carrying the dissection from the end of the hepatic duct directly through the strictured area down along the margin of the gastrohepatic ligament. Even after months of complete obstruction, the common duct will be found normal in size and not contracted. The stricture is dissected out until the ends of the hepatic and common ducts lie free. Several chromic catgut sutures are introduced catching the tissues behind the duct ends; these, when tied,



FIG. 79.—End of common and hepatic ducts sutured with through-and-through chromic catgut. Dotted line shows where the end of the common duct is enlarged by short longitudinal incision. (Mayo.)

obliterate the gap and approximate the hepatic and common ducts so that they can be sutured without tension. The posterior margins of the cut ends are united by through-and-through sutures (Fig. 79), the open end of the common duct is split for one-third of an inch of its anterior lip rendering its coaptation to the dilated hepatic duct easier. A T-tube of appropriate size is now introduced, with one arm extending about one inch into the hepatic duct, the other, if possible, passing through the entire length of the common duct until its free end lies in the duodenum (Fig. 80). The T-tube is anchored with absorbable sutures in the hepatic and common ducts, and the line of their union covered by such omental or peritoneal tissues as may be available for the purpose. With a syringe, normal salt solution is forced through

the T-tube until the fluid is demonstrated to run freely into the duodenum. The T-tube is now surrounded by a few rubber tissue drains, Morison's pouch, in the right renal area, if drainage be indicated is drained by a rubber tube led out through a stab-wound in the loin. The T-tube is left in place for three weeks.

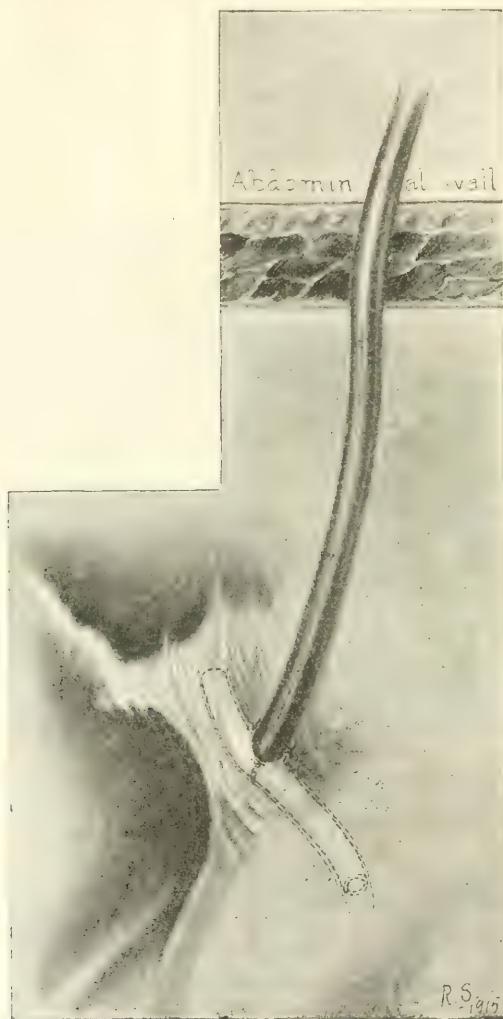


FIG. 80.—“T” tube in place. Duct ends sutured about it. (Mayo.)

**DIVULSION OF STRICTURE OF THE COMMON DUCT WITH FORCEPS.**  
Strictures of the pancreatic portion of the duct often follow ulcerations. They usually have the character of a diaphragm and will pop like paper on passing forceps through them into the duodenum. The

stricture is then completely divulsed by adequate separation of the forceps blades. More extensive strictures in this locality attacked by the transduodenal route. Here, too, a drainage of the common duct with the T-tube is instituted, the lower end of the tube passing into the duodenum.



FIG. 81.—Direct union of hepatic duct to duodenum. Gall-bladder has been removed. Continuous chromic catgut sutures have been placed uniting posterior wall. The stay sutures, holding hepatic duct to duodenum, of interrupted chromic catgut, lie behind this suture and are not shown. (Mayo.)

Extensive injuries to the common bile duct necessitating UNION OF THE HEPATIC DUCT TO THE DUODENUM (Fig. 81). Such an operation was performed at the Mayo Clinic for the first time in 1905, and the patient has been well for ten years, so far as her biliary apparatus is concerned. In this type of case, the stomach and duodenum have been found closely adherent to the site of the injury. If care is taken NOT TO SEPARATE THE ADHESIONS TOO EXTENSIVELY, the duodenum may

be so closely approximated to the dilated hepatic duct as to permit a two-row anastomosis without great difficulty, on the general principles of gastro-intestinal union. The suture line is reinforced with an omental plastic. In one case of this sort a contracted gall-bladder about one inch in length was present. The gall-bladder was fashioned into a pedunculated flap and filled in a considerable gap. In another instance, a flap was dissected from the duodenum, according to the method of Walton (see below).

SULLIVAN'S METHOD of uniting the bile passages to duodenum (by rubber tube) was successfully used in a modified way as follows: The hepatic duct was united as well as possible by a mucomucous suture

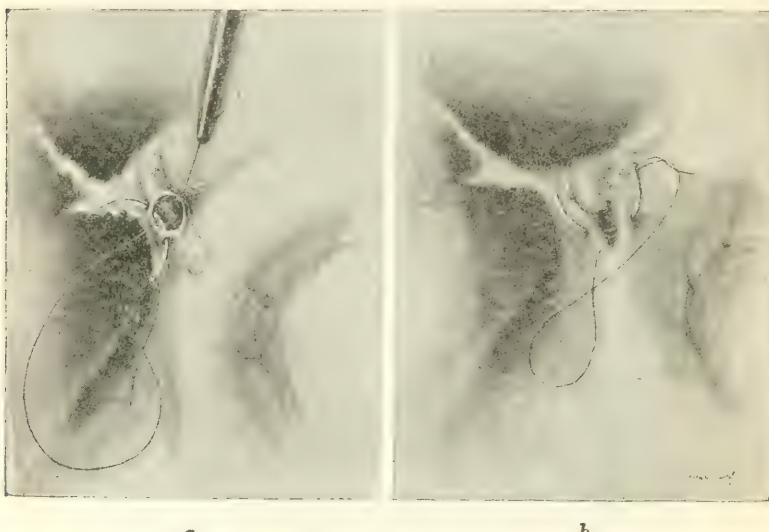


FIG. 82.—*a*, rubber tube in place and fastened by chromic catgut suture to the hepatic duct. Anterior layer of chromic catgut continued. *b*, duodenum being sutured to enfold anastomosis, the area later to be covered by omentum. (Mayo.)

to an opening in the duodenum, and a rubber tube introduced and sutured into position (Fig. 82). The suture was continued so that at least some portion of the new canal might be mucous lined. The line of union was, of course, not bile-tight, but, by surrounding it with omentum, it did not seem to leak into the peritoneal cavity. The tube extended up the hepatic duct to the primary division and projected about one inch into the duodenum. After absorption of the holding sutures, the rubber tube readily passed into the intestinal tract. This method was the operation of choice in the majority of cases, and has given good results in a number of instances.

DIRECT UNION OF THE COMMON DUCT TO THE DUODENUM FOLLOWING RESECTION OF THE COMMON DUCT FOR CANCER, OR AFTER PARTIAL

GASTRECTOMY. After removing the involved portion of the common duct, the distal end is tied, the stump covered with peritoneum, and the proximal end is united to the duodenum after the method of Coffey (using the common duct instead of a catheter in a Witzel enterostomy). This is applicable in primary operations when the liver end of the duct is easily accessible. In secondary operations there are so many adhesions that the ducts cannot be properly mobilized to render it feasible.

WALTON'S RECONSTRUCTION OF THE COMMON BILE DUCT WITH A DUODENAL FLAP. Walton<sup>1</sup> deals with those cases where absence or small size, of the gall-bladder precludes the possibility of a cholecyst-enterostomy. With an impassible obstruction at the lower end of the common bile duct, and no biliary fistula, the duct is dilated to so marked a degree that it is not difficult to form an anastomosis between it and the intestine. In a second group, the presence of a biliary fistula permits the patent portion of the duct to remain small, so that anastomosis becomes difficult or impossible. It was in a case belonging to the latter group in which the common duct ended abruptly about a quarter of an inch below its junction with the cystic duct, in which Walton proceeded as follows:

A flap was cut out of the duodenum and turned downward (Fig. 83), a tube was inserted into the end of the common duct and sutured in place with chromic catgut. The wound in the duodenum was sutured in its upper part, leaving only an opening sufficient to admit the tube (Fig. 84). The tube was inserted into this opening, the duodenum being drawn up as close as possible to the cut end of the duct with catgut sutures (Fig. 85). The flap of duodenal tissue was now sutured around the rubber tube so as to make a new bile duct (Fig. 86). A small drainage tube was inserted down to this new junction. The rubber tube was passed by rectum twenty-five days later, and the patient made an uneventful convalescence. The patient was well five months after the operation, performing his military duties without discomfort.

Walton's article contains an excellent review of the existing methods for reconstruction of the bile duct. He, however, has omitted the method of Monprofit, reviewed in this section in June, 1910.

Philippowitz<sup>2</sup> gives a fairly complete account of the different methods for reestablishing connection between the biliary system and the intestine. In this foreign article one recognizes methods ascribed to authors other than those we are accustomed to credit in American literature. For example: Verhoogen and Jenckel are considered to be the inventors of the method of using a rubber tube connecting the central stump with the duodenum, instead of Sullivan.

Giacinto and Luigi<sup>3</sup> report unsuccessful attempts to substitute a vein for the common bile duct.

<sup>1</sup> Surgery, Gynecology and Obstetrics, September, 1915, p. 269.

<sup>2</sup> Beitr. z. klin. Chir., 1915, xciv, 487.

<sup>3</sup> Zentralbl. f. Chir., 1915, p. 383.

**Ligation of the Portal Vein in Suppurative Portal Phlebitis.** In a very suggestive paper, Edwin Beer<sup>1</sup> discusses the possibility of attacking pylephlebitis along the lines employed in septicemias of otitic and of uterine origin. He quotes the following remarks of A. G. Gerster, made

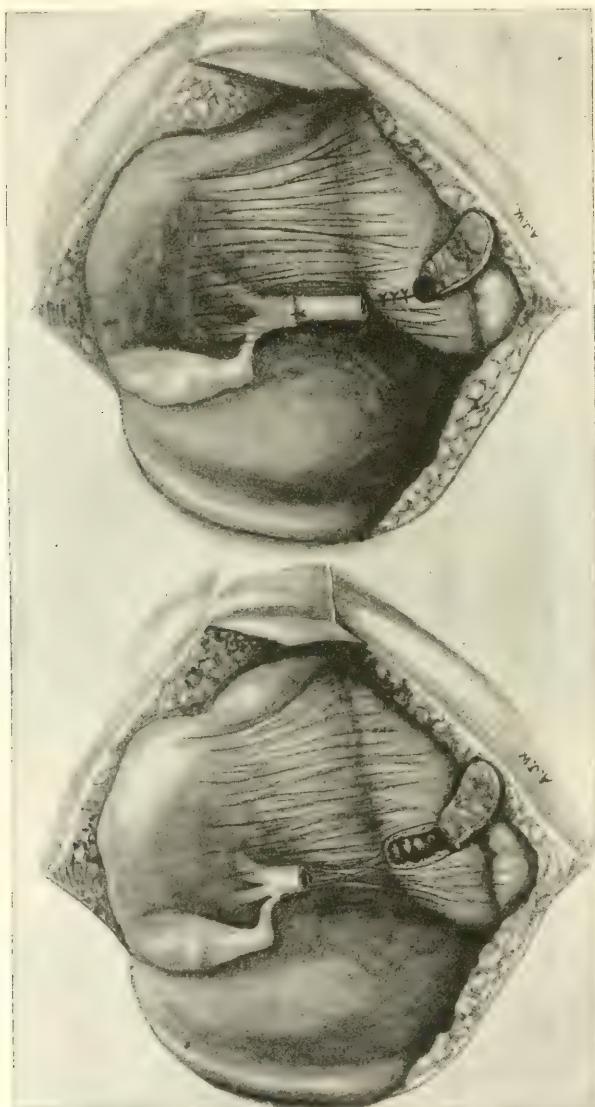


FIG. 84.—Tube sutured in duct, opening in duodenum partly sutured. (Walton.)

FIG. 83.—Showing duct divided and opening made into duodenum. (Walton.)

in 1903: "The evacuation of septic thrombi from the jugular vein in mastoid disease has yielded such excellent results that the application of this principle to the portal vein would be natural and logical.

<sup>1</sup> American Journal of the Medical Sciences, October, 1915, p. 548.

But the anatomical relations, while very favorable in the former instances, are just the reverse in the latter. Only a short piece of the portal vein, situated in the hepatoduodenal ligament, is approachable." "Hence, though phlebotomy in the portal trunk in the hepatoduodenal

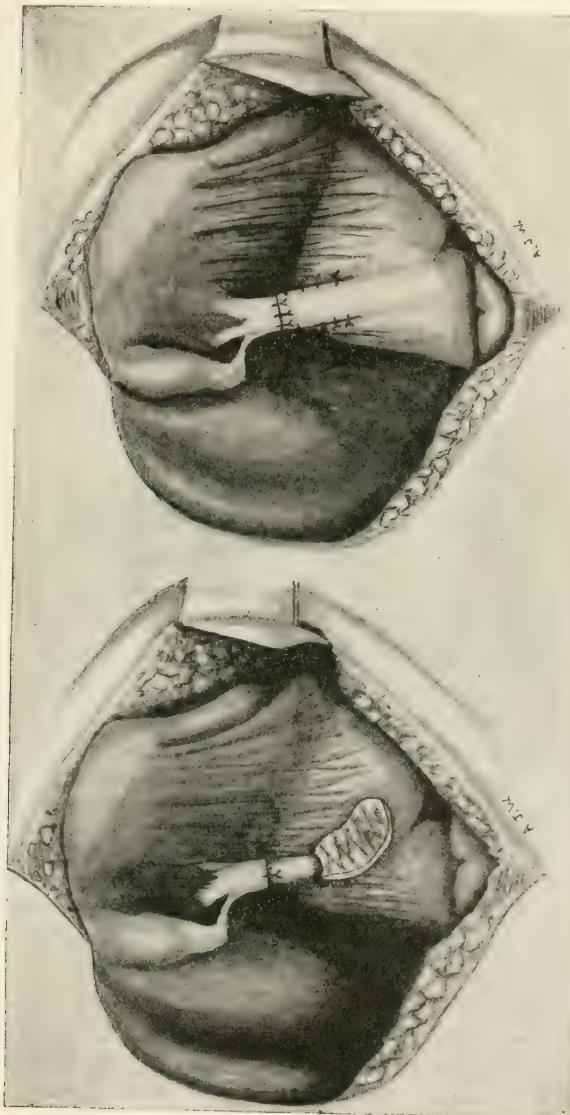


FIG. 85.—Tube inserted into duodenum drawn up as close as possible to common duct. (Walton.)  
FIG. 86.—The duodenal flap sutured around the rubber tube. (Walton.)

ligament is not impossible, the evacuation of thrombi by flushing through a catheter seems to be too problematic, not to mention the technical difficulties the surgeon might encounter in the closure of the phlebotomy wound."

The work of H. Neuhoef on the experimental ligation of the portal vein is then considered. Following the well-known principle that gradual occlusion of a vessel is much better borne than immediate ligation, Neuhoef established the fact that a gradual occlusion of the portal vein was not fatal. The cases of Brewer and Burdenko were then cited to show that a gradual occlusion from pressure, followed by a ligation, was compatible with life, provided collateral circulation had been established. In view of these facts, Neuhoef advocated ligation of the portal vein in suppurative pylephlebitis, believing that the portal thrombus by gradually occluding the portal vein, might have induced the development of a collateral circulation prior to the ligation of the vein, such ligation also preventing further bacteria being swept from the radicals of the superior mesenteric vein into the liver. The animal experiments of Burdenko were also cited, in which it was shown that the portal vein could be successfully ligated provided preformed anastomoses produced by operative adhesions existed between the parietes and the omentum and intestines.

Beer considered that interference at a lower level, *i. e.*, upon the ileo-colic vein, would have no effect. He planned, therefore, to attack the condition (as soon as diagnosed) in the following manner: To establish adequate collateral circulation at a first operation by a venous lateral anastomosis between the left spermatic vein a few inches below its confluence with the left renal vein and one of the larger branches of the inferior mesenteric vein; to this would be added an omentopexy. At a second operation, it was planned to ligate the portal vein, cut the vein above the ligature, and drain the hepatic end with rubber tubing led into the lumen of the stump and, at the same time, perform a cholecystostomy to drain the biliary system.

Following the operation upon the third day of an acute gangrenous appendicitis, Beer's patient ran a septic temperature with daily chills and icterus. Three days after the first operation, the patient was again taken to the operating room with the intention of anastomosing the inferior mesenteric vein with the left spermatic vein and also performing an omentopexy so as to establish collateral circulation (preliminary to ligation of portal vein for pylephlebitis). An incision was accordingly made along the crest of the ilium to the left of the left rectus muscle. The lower pole of kidney and the ureter were exposed; the spermatic vein was isolated, likewise a branch of the inferior mesenteric vein. Attempted anastomosis was unsuccessful owing to the very small caliber and thin wall of the inferior mesenteric branch. The peritoneum was then opened preliminary to omentopexy and the portal fissure was palpated. An indurated area and enlarged glands were felt at the portal fissure. The omentum was brought down and sutured into the parietal peritoneal opening which was then closed. The wound was closed in layers. No ascites was found; the vessel

in the omentum and branches of inferior mesenteric vein showed but little abnormal congestion.

Three days later, ligation of the portal vein for suppurative phlebitis was performed, followed by cholecystectomy for drainage of the bile tracts. The abdomen was opened through a five-inch right rectus incision. There was marked venous congestion of the stomach and gastrohepatic ligament. Numerous glands of deep red color were found just above the duodenum over the portal vein; the latter was exposed higher up. It was impossible to determine whether or not thrombosis was present. The vein was tied with heavy catgut. A rubber dam ligature was led down to site of ligation; it was brought out alongside the cholecystostomy tube. A layer suture closed the abdominal wound.

The patient lived for two days, during which time there was absence of all signs and symptoms of obstruction to the return flow of the portal blood, in spite of ligation of the portal vein at the hilus. Beer says he does not know how this can be explained.

While it would be easy enough to criticize the various operations designed to control suppurative pylephlebitis by emphasizing the impossibility of knowing just how extensive the involvement in any given case is, such criticism would be contrary to the spirit of modern progressive thought.

**Hemostasis in Resection of the Liver.** Picone,<sup>1</sup> in reporting 2 cases of liver resection, brings out technical details of interest. In the first case a fibrosarcoma the size of a child's head was situated in the left lobe of the liver. It was extirpated by section through healthy tissues. The structures in the free edge of the lesser omentum, common duct, portal vein and the hepatic artery were temporarily clamped, according to the method of Bastianelli and Macaggi, causing immediate and extreme congestion of all the intraperitoneal organs. For permanent hemostasis, through-and-through, U-shaped sutures were employed. The cutting of these was prevented by strips of rubber laid upon the surface of the liver. In addition to this, the mouths of the larger vessels on the cut surface were tied, and, lastly, a flap of omentum was used to cover the raw surface like a Mikulicz tampon. In a second case in which a calcified echinococcus cyst was removed, a similar procedure was varied by using strands of catgut instead of strips of rubber.

**Recoveries from Enormous Abscesses of the Liver** are reported by C. B. Pasley.<sup>2</sup> In the first case, the abdomen was enormously distended, resembling that of a full-term pregnancy. The tumor extended equally into both flanks and practically filled the entire abdominal cavity. No amebæ were found. In the second case, a similar tumor extended down to within an inch and a half of the symphysis pubis. The only

<sup>1</sup> Clin. Chir., 1914, 22, 9, p. 1817.

<sup>2</sup> Lancet, May 22, 1915, p. 1076.

medicine given to these cases was one and a half grains of emetin per day for three weeks by hypodermic. Both patients recovered.

**Biliary Pleurisy as a Result of Transpleural Injury to the Liver** was observed by Gaza.<sup>1</sup> The wound of entrance was in the fourth intercostal space close to the nipple, that of exit was in the tenth intercostal space. An enormous biliary effusion in the right pleural cavity was followed by an inflammatory serous exudate. After the acute symptoms (with displacement of the mediastinum and the heart) subsided, there developed a chronic emaciation, with marked cardiac weakness and rapid loss of strength. The clinical picture was like that of the biliary peritonitis reported by Landau (see *Gunshot Wounds of the Abdomen* above). Drainage of the pleural cavity, three weeks after injury, was followed by recovery.

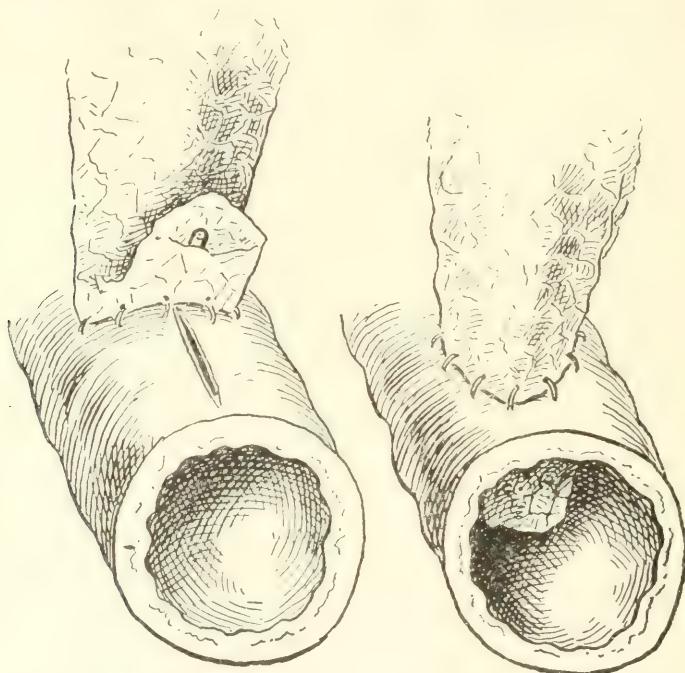


FIG. 87.—Diagrammatic representation of the method of inserting pancreas into bowel.

### THE PANCREAS.

**Experimental Implantation of the Pancreas into the Bowel.** Sweet and Simons,<sup>2</sup> found that if the cut end of the pancreas containing some

<sup>1</sup> Berl. klin. Wehnschr., 1915, No. 16.

<sup>2</sup> Annals of Surgery, March, 1915, p. 308.

pancreatic duct were fastened to the intestine by a continuous suture placed about one-half-inch from the cut end of the organ (see Fig. 65a), this suture could then be carried about half-way around the circumference which would lie beneath the organ. The intestine then is opened by a longitudinal slit (Fig. 87) one-half of which wound lies within the area enclosed by this continuous suture. The pancreas is then inserted into the lumen of the gut and the continuous suture completed around the remaining half of the pancreas. The results were uniformly good.

To the operator who is confronted with the necessity of removing a carcinoma of the head of the pancreas, or carcinoma of the ampulla of Vater and lower part of the common duct, it will be of distinct value to know that the cut end of the pancreas can be safely anastomosed to the intestine in the manner described above.

### THE SPLEEN.

**Splenectomy.** SPLENECTOMY FOR HEMOLYTIC ICTERUS was discussed in previous numbers of PROGRESSIVE MEDICINE.<sup>1</sup> A recent article of Elliott and Kanavel<sup>2</sup> gives a summary of our present knowledge of the condition. These authors have collected 47 cases from the literature, to which is added 1 of their own. They elaborate both upon the familial and the acquired types. In the familial type, the blood destruction does not reach a severe grade, in fact many individuals with familial hemolytic icterus have lived to an old age in perfect health. In the acquired type, the progress of the disease is much more rapid.

In the familial type it has been observed that children of an affected family seem to suffer more severely than do the parents. The disease appears with variable intensity in the various members of one family through several generations.

In the acquired type the symptoms progress more rapidly, and the hemolytic crises occur with greater frequency. These crises are present in both the familial and acquired types of the disease. They consist of a marked increase in size and tenderness of the spleen, with malaise, headaches and slight fever, accompanied by an intense hemolysis, sometimes with hemoglobinemia at the height of the crisis, and a marked increase in the jaundice. The liver is slightly enlarged and tender, and may present a liver crisis produced by the passage of the thickened bile or pigment stones through the ducts, thus giving the typical signs of gall-stone disease. Unless this complication occurs, the stools are of normal color. The red blood cells show the typical, increased fragility. The amount of anemia depends upon the efficiency of the hemopoietic system.

<sup>1</sup> June, 1914 and 1915.

<sup>2</sup> Surgery, Gynecology and Obstetrics, July, 1915, p. 21.

In many cases the course is so mild that surgical treatment is not indicated. Splenectomy has been of remarkable benefit. It is indicated in the steadily progressing type in order to forestall the complications on the part of the biliary system, as well as the result of severe acholuric crises. Elliott and Kanavel believe that splenectomy is particularly indicated in younger individuals in whom one should not wait for the large splenic tumor or marked general disability before operating.

*Technic.* In their case, 10 minimis of adrenalin, 1 to 1000, was given hypodermically one half-hour before operation. This, they claim, reduced the diameter of the spleen at least two inches and restored a corresponding amount of blood to the circulation. No ill-effects were observed from this, as possibly forcing toxins out of the spleen. There was no increase in hemolysis. They advise routine examination of the gall-bladder and bile passages at every laparotomy for splenectomy.

Mortality of splenectomy for hemolytic icterus is low. Of the 48 cases, only 2 died.

After splenectomy for hemolytic jaundice, Faber<sup>1</sup> says that the red cells, while still abnormally fragile, are less so than before operation.

Goldschmidt, Pepper and Pearce<sup>2</sup> report a case of splenectomy in a child with hemolytic icterus. The urobilin diminished to one-ninth of the amount excreted before splenectomy.

**SPLENECTOMY FOR PERNICIOUS ANEMIA.** Robertson<sup>3</sup> reports splenectomy in 6 cases of pernicious anemia. There was a marked increase in the urobilin output in the stools immediately after operation. Robertson found that in those cases which suffered a relapse after splenectomy, variations in the urobilin could be taken as an indication of corresponding changes in the course of the disease, and that such variations in the urobilin could occur before there was any change in the number of red cells. He concludes that the determination of the urobilin output as an index of blood destruction is the most accurate means we have of estimating the effect of treatment.

Elsewhere Lee, Vincent and Robertson<sup>4</sup> report on 5 cases. They say that symptomatically the improvement, during the first few weeks succeeding splenectomy, was much greater than the blood picture would indicate; and, while the blood picture still exhibits the accepted characteristics of pernicious anemia with the exception of the color index, the remissions thus brought about are more marked, in the majority of cases, than by any known therapeutic procedure other than splenectomy.

In speaking of the pathological changes found in seven spleens removed at the Mayo clinic for pernicious anemia, Wilson<sup>5</sup> states that the

<sup>1</sup> Hospitalstidende, June 16, 1915, p. 581.

<sup>2</sup> Archives of Internal Medicine, September, 1915.

<sup>3</sup> Ibid.

<sup>4</sup> Journal of American Medical Association, lxy, 216.

<sup>5</sup> Annals of Surgery, lxii, 158.

average weight of the extirpated organs was 463 grams. He goes on to say: "The increase in weight is out of harmony with our conception of the atrophy usually found in the spleen in cases of pernicious anemia. Here again discrepancies probably accounted for by the fact that in the last stages of pernicious anemia the spleen becomes atrophic while our figures, based on operative cases, showed increased weight of the organ. Entire absence of pigment in these relatively early cases is again in contradiction to the usually accepted statement that in cases of pernicious anemia the spleen is pigmented. (The average duration of symptoms was twenty-seven months; the average age of the patients forty-four years at time of operation.)

Vanden Bergh and Snapper<sup>1</sup> treated dogs with phenyl hydrazene so that they developed a pernicious anemia. The spleen was enlarged. More bilirubin was found in the splenic vein than in the splenic artery.

**SPLENECTOMY FOR SPLENIC ANEMIA IN CHILDHOOD AND FOR THE SPLENIC ANEMIA OF INFANCY.** Giffin,<sup>2</sup> of the Mayo Clinic, has contributed a most instructive paper upon this subject. Giffin discusses both the adult form of splenic anemia as it occurs in childhood and the splenic anemia of infancy, so-called von Jaksch's disease. This latter has no relation to leukemia.

Attention is called to the fact that the blood of children and particularly the blood of infants under two years old differs normally from the blood of adults. A lymphocytosis (a lymphocyte percentage of 40 to 50) is quite a normal constant, and marrow cells are occasionally observed. It is not uncommon in the anemia of infancy to find a lower red cell count, with a consequent higher color index, the occurrence of degenerated red cells, the presence of normoblasts and occasional megaloblasts and a leukocytosis of 10,000 to 20,000 with the presence of eosinophiles and myelocytes.

Giffin cites Hunter who has divided the splenic anemias of childhood and infancy into three types. In the first type, which corresponds to the splenic anemia of adults, there is a large spleen, anemia and no leukocytosis. Lymphocytes are present in a normal percentage (40 or 50 per cent.). The second type includes cases in which the leukocyte count is between 10,000 and 20,000. The third embraces those in which the leukocyte count is above 20,000, with great numbers of normoblasts, together with an occasional megaloblast, eosiniphiles and myelocytes. Giffin believes there is no essential difference between types two and three; consequently, he divides the cases into two groups: (1) those corresponding to the splenic anemia of adults with absence of leukocytosis, and (2) those constituting the splenic anemia of infancy.

<sup>1</sup> Journal of American Medical Association, lxxv, 915.

<sup>2</sup> Annals of Surgery, December, 1915, p. 679.

showing a leukocytosis, the presence of a variable number of marrow cells and a relatively high color index.

Giffin collected 6 cases of splenic anemia in childhood from the literature and adds 1 of his own. The patient was two and a half years old, and made an uneventful convalescence.

In discussing splenectomy for splenic anemia in infancy, Giffin remarks that for the present, at least, it is useful to regard certain severe cases of secondary anemia in infancy, with marked splenomegaly and a more or less characteristic blood picture, as a separate disease entity in spite of the frequent association with rickets. Giffin was able to find but 4 unquestioned cases in the literature in which splenectomy had been performed for the splenic anemia of infancy: No. 1. (Wolf) operated, in 1906, upon a boy aged eighteen months. Three years later the patient was presented and was found in excellent general condition. The blood picture was normal except that the leukocytes had remained increased.

No. 2. (Grant) in 1907, operated upon a fifteen-months-old baby. In nine months the patient was quite well, had gained in weight, and the blood was almost normal. No. 3. Fowler, in 1914, operated on a fourteen-months-old girl baby. She made a good operative recovery. No. 4. Poole, in 1914, operated on a boy of about five years (preliminary transfusion of 150 c.c. of blood). Three months after operation the patient was reported to be not quite as well as he had been at two months. Attention is called to the excellent results obtained by splenectomy in severe types of the disease.

In discussing etiology, the ideas of Ashby, among others, were quoted, namely, that the toxins causing rickets might also cause splenic anemia of infancy; and that the reported cases varied from those with marked bone changes and small spleens to those with slight bone changes and very large spleens. Carr, quoted by Giffin, points out that in a majority of rickety children there is no splenic enlargement and that there is no connection between the severity of the rickets and the size of the spleen or the degree of the anemia. Moreover, that in certain cases of splenic anemia of infancy there is no evidence whatever of rickets. "The general experience seems to indicate that, granted the frequent association with rickets, there are yet certain cases which, on account of their marked splenomegaly and their severe anemia their evidences of extensive blood destruction and a reversion to the fetal type of hemopoiesis, should, for the present at least, be grouped together as a separate disease entity." Moreover, in the splenic anemia of infancy there is more evidence of blood destruction than in the splenic anemia of adults.

**SPLENECTOMY FOR BANTI'S DISEASE.** J. B. Blake<sup>1</sup> advocates early removal. Transfusion is a valuable aid in temporarily improving the

<sup>1</sup> Annals of Surgery, September, 1915, p. 315.

patient's preoperative general condition, allowing twenty-four to forty-eight hours to elapse between transfusion and operation. Moreover, a transfusion a week or ten days before the one immediately preceding operation may also be of advantage. Blake believes splenic anemia to be more common than is held at present. Failure to make an early diagnosis is explained: (1) by the fact that the spleen must be increased to about three times its normal bulk before it can be palpated; (2) by the lack of a careful physical abdominal examination in all cases of anemia.

Blake remarks upon the conservative attitude of most pediatricians in the treatment of children with anemia associated with enlarged spleen and liver and having leukocytosis. Most of such cases improve under proper hygienic treatment in the country. Blake points out that some cases fail to improve under such treatment, they are usually considered "disturbances of nutrition."

SPLENECTOMY FOR SPLENOMEGLY WITH MARKED EOSINOPHILIA was reported by Wilson<sup>1</sup> from the Mayo Clinic. There was a secondary anemia, with a leukocyte count of 15,000, and 66 per cent. eosinophiles. The spleen weighed 2110 grams. The patient has done well since operation (one year) in spite of the fact that the leukocytes have risen to 138,000, of which 75 per cent. to 80 per cent. are eosinophiles.

SPLENECTOMY FOR KALA-AZAR. Kokoris<sup>2</sup> says that kala-azar produces splenomegaly in children. He removed the spleen in 3 cases. Two children died without improvement, but the third recovered, and was well three years after operation.

THE TECHNIC OF SPLENECTOMY ACCORDING TO W. J. MAYO<sup>3</sup> was reviewed in this section two years ago. In a more recent communication the same author<sup>4</sup> brings out a number of additional points of technical interest.

*Adhesions.* Hemorrhage from broken-down adhesions should be controlled temporarily by a large gauze pack until the spleen can be delivered and removed (Fig. 88). If the adhesions are so strong that they must be divided by a cutting instrument, it is well to make an opening in them close to the splenic capsule, effecting enucleation by a combination of sharp and blunt dissection.

*Division of the Splenic Ligament.* The vasa brevia, which lie in the gastrosplenic ligament, constitute the most important vascular attachments. Most of these can be delivered with the spleen, since the stomach can be drawn from the abdomen to a very considerable extent before separating the gastrosplenic ligament. However, in enlarged adherent spleens there may be vascular connections in the deeper portion of the

<sup>1</sup> Annals of Surgery, lxxii, 158.

<sup>2</sup> München. med. Wehnschr., 1915, No. 30.

<sup>3</sup> PROGRESSIVE MEDICINE, June, 1914, p. 176.

<sup>4</sup> August, 1915, p. 172.

gastrospenic ligament which pass backward and inward to anastomose with vessels along the spine and crux of the diaphragm. Since these must be separated before the spleen can be delivered, early adjustment of an adequate gauze tampon for temporary control of hemorrhage

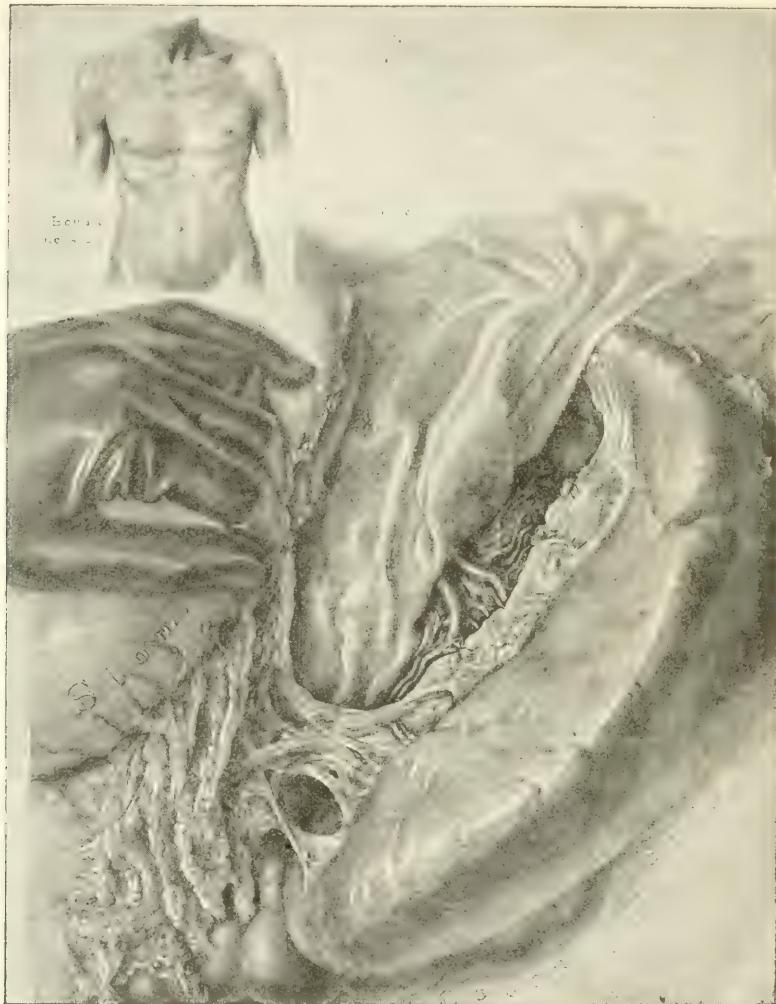


FIG. 88.—The Bevan incision for splenectomy, shown in upper figure. Lower figure method of using gauze pack for temporary hemostasis to control bleeding of separated adhesions. (Mayo.)

is often essential. The lienorenal ligament has no great vascularity and can be readily divided. After delivery of the spleen, the rest of the gastrospenic ligament and a leash of vessels passing to the inferior border of the spleen, connecting it with the splenic flexure of the colon,

are tied in sections. The spleen can now be lifted, so that the vascular pedicle lies completely exposed for at least two inches.

*Pancreas.* As a rule the tail of the pancreas lying in the pancreatic notch of the spleen behind the hilum can readily be separated. In three splenectomies, Mayo tied off a portion of the tail with the splenic pedicle, in one case removing as much as an inch and a half. The spleen was bleeding so freely from lacerations that no time could be spared for separation. No harm resulted from tying off the pancreas.

*Vascular Pedicle.* Serial ligation of the vessels is the method of choice. Ligation should precede any cutting of the pedicle. Once when the pedicle tore before it could be ligated, Mayo was able to catch the vessels in his fingers and hold them until forceps could be applied. If the pedicle cannot be delivered, rubber-covered clamps should be used to compress it for the sake of temporary hemostasis. In addition to the pedicle, these may also include part of the stomach wall in their grasp. Twice the stomach was injured in this way. Once a portion of the stomach wall was included in the ligature passed around the pedicle. There was no escape of contents, and it was possible to repair the damage. In a second case, two forceps were used to grasp a torn vessel in the wall of the stomach; the fragile gastric wall was lacerated, there was an escape of contents, and the patient died from sepsis a few days later.

If the vascular pedicle has been exposed, but is too short to permit accurate ligation of its vessels, the two-forceps method (so frequently employed for ligation of the renal vessels) can be used. This consists in placing two forceps three-quarters of an inch apart on the pedicle. The spleen is cut away without regard to back bleeding. A catgut ligature is thrown around the pedicle below the proximal forceps, which is then loosened and the ligature tied in the groove of crushed tissue, while the distal forceps steadies the pedicle and prevents retraction. A second ligature makes the pedicle still more secure.

Next the class of cases is considered in which splenectomy is indicated, but where the condition of the patient, or the extensive attachment of the spleen makes extirpation inadvisable. Two years ago Mayo suggested partial ligation of the splenic vessels as analogous to ligation of the thyroid arteries in hyperthyroidism. Such a step could not be done with any degree of accuracy unless delivery of the spleen were accomplished, and in that event, splenectomy would be equally easy and more effective. Mayo then referred to the reviewer's suggestion of ligature of the splenic artery close to the celiac axis and of the gastro-epiploica sinistra near the spleen (see below).

*Closure of the Splenic Space.* "Complete hemostasis is absolutely essential. Compression with a large temporary tampon will enable the smaller vessels to become sealed in a few minutes, but, in the deeper recesses of the wound there will probably be vessels requiring other

treatment. Beginning with the tied splenic vessels, the raw space is covered in by running sutures of catgut on a small curved needle. The margin of the lienorenal ligament on the outer side is sufficiently firm to hold a suture, but on the inner side, such bits of tissue must be caught here and there as can be done safely until the bleeding vessels are compressed. The last sutures come well down on the diaphragm and had best be applied during cardiac diastole and during expiration." If oozing persists, a tampon must be left *in situ* to control it. If the wound is quite dry, the abdomen is then closed in the usual manner.

**THE MORTALITY OF SPLENECTOMY.** In 14, of a series of 58 cases,<sup>1</sup> there was marked edema of the lower extremities. Seventeen had ascites coincident with myocardial and renal changes. A high grade of anemia was frequently present. In spite of all this there were but 5 deaths, and 2 of these were from preventable causes (hemorrhage and sepsis) hence, even under such unfavorable conditions, surprisingly few patients died directly as a result of the operation.

**MESENTERIC THROMBOSIS AS A POSTOPERATIVE COMPLICATION OF SPLENECTOMY** is reported by Scudder.<sup>2</sup> The spleen was removed for a marked splenic anemia with hemophilia. Preliminary transfusion effected transient improvement but did not check the tendency to bleeding, although the blood coagulation time was five minutes. The spleen extended 14 cm. below the costal margin in the nipple line. For six days after splenectomy the patient made an uneventful convalescence. On the seventh day he began to have cramp-like abdominal pains, relieved by enemata. The attacks of pain increased in frequency and severity so that, on the thirteenth day after operation, there was a typical picture of intestinal obstruction. Laparotomy revealed mesenteric thrombosis. Resection, and end-to-end anastomosis was performed. The patient did not rally from the operation. No autopsy was permitted.

A similar case of mesenteric thrombosis following splenectomy is reported by Giacomo Zaccarini.<sup>3</sup> The patient was a woman, aged forty years, with splenomegaly associated with anemia of five years' duration. Splenectomy was followed by uneventful convalescence for thirteen days; then fever and intestinal hemorrhages set in. Death took place the next day. Autopsy showed multiple thrombi and phlebosclerosis of the splenic, portal, and mesenteric veins, with hemorrhagic infarction of the small intestines. (One infarct was present in the extirpated spleen.) The thrombosis of the mesenteric vein was the immediate cause of death, but Zaccarini believed it to be secondary to primary thrombosis of the splenic vein.

<sup>1</sup> Among these 27 of splenic anemia and 7 of pernicious anemia.

<sup>2</sup> Annals of Surgery, November, 1915, p. 530.

<sup>3</sup> Deutsch. Ztschr. f. Chir., Bd. 132, p. 406.

In the same category belongs the case reported by Lindblom<sup>1</sup> of a woman, aged fifty-six years, with two healthy children. At the age of forty, the enlarged spleen was first noticed; at forty-six, attacks of hematemesis began. For five years after this she was supposed to be suffering from Banti's disease. Then ascites set in. The patient died of an intercurrent erysipelas. Autopsy showed the causative lesion to be a syphilitic degeneration of the vessel walls entailing thrombosis of the splenic veins. The involvement of the portal vein was the cause of the ascites. Lindblom points out that splenectomy is peculiarly risky in such cases. While the Wassermann reaction was constantly negative, he nevertheless suspected the syphilitic nature of the trouble from a

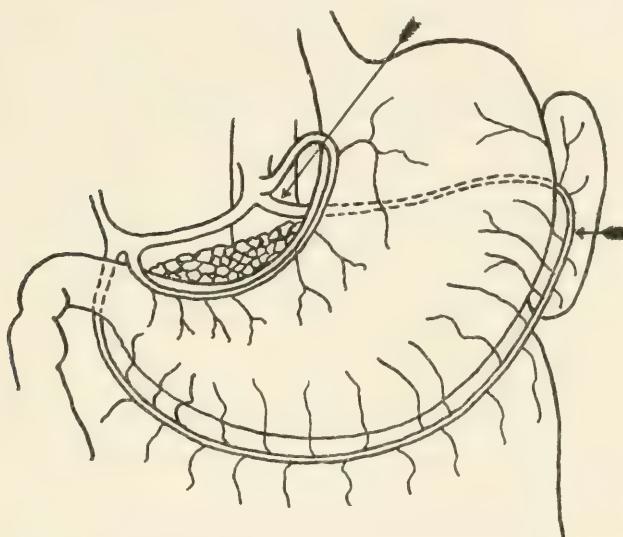


FIG. 89.—Diagram of the celiac axis and its branches (after Morris). Arrows point to sites for ligations of the splenic artery close to the celiac axis and the gastro-epiploica sinistra where it joins the stomach wall after leaving the splenic artery. (J. C. A. Gerster.)

perforation of the septum, a history of optic neuritis twenty-one years before, assumed to be a brain tumor at the time, and the fact that the temperature fluctuated under iodide of potassium.

**Ligation of the Splenic Vessels in the Surgery of the Spleen.** To facilitate control of hemorrhage in the course of difficult splenectomies, the reviewer<sup>2</sup> has suggested *temporary* ligation of the arterial supply of the spleen at more accessible points than the splenic pedicle, namely, the splenic artery close to the celiac axis and the gastro-epiploica sinistra where it joins the stomach after leaving the splenic (Fig. 89).

<sup>1</sup> Hygiea, lxxvii, 705.

<sup>2</sup> Journal of American Medical Association, lxv, 527.

"The celiac axis is readily exposed through an opening in the lesser omentum just above the lesser curvature of the stomach; (it may be made to come within an inch or so of the anterior abdominal wall by hyperextending the patient's spinal column by means of the elevator of the operating table commonly used for flexing the trunk in kidney and gall-bladder operations). Fully 2 inches of the splenic artery lie just beneath the posterior parietal peritoneum; ligation here certainly offers no difficulties. This, however, does not shut off the entire arterial supply of the spleen because of the free anastomosis of the gastro-epiploica sinistra (branch of the splenic) with the gastro-epiploica dextra (as shown in the accompanying illustration). It is proposed, therefore, that the gastro-epiploica sinistra be ligated where it reaches the stomach wall and just before it begins to send off branches to the anterior and posterior surfaces. Although this point is not so accessible as that just described in the course of the splenic, it is nevertheless readily brought into view by drawing the stomach and left margin of the great omentum over to the right. Theoretically the vasa brevia should also be ligated, but their anastomotic communications on the stomach wall with the gastro-epiploica sinistra (proximal to the point of ligation) will rarely be of sufficient magnitude to demand this. While cessation of the arterial stream does not afford absolute hemostasis, the hemorrhage from the torn veins alone is easier of control and is certainly less than if it came from both arteries and veins.

After the spleen has been removed, the mouths of the larger vessels in the stump of the pedicle can easily be recognized and ligated. The ligatures on the splenic and gastro-epiploica sinistra are now gradually released in succession so that if any arterial branches in the pedicle have been overlooked, they can be caught and tied.

As to the permanent ligation of the splenic arterial supply, according to this method, W. J. Mayo considers that the bloodvessels to the pancreas and stomach, which are thus put out of commission, are not of sufficient magnitude to cause trouble, and he believes that the blood supply would be well taken care of by the numerous anastomotic branches from other sources.

*Ligation of the splenic vessels as a substitute for splenectomy* was spoken of in PROGRESSIVE MEDICINE for June, 1915 (p. 185). The author's method, as described above, is also intended to be used as a substitute for splenectomy where circumstances (such as poor condition of the patient or dense perisplenic adhesions) would render removal unusually hazardous.

Troell<sup>1</sup> suggests that ligation of a larger or a smaller number of splenic vessels at the hilus of the spleen is a simpler and less dangerous procedure than splenectomy. Elsewhere he says that on account of its

<sup>1</sup> Annals of Surgery, January, 1916, p. 88.

simpler technic and presumably lower mortality, ligation of the splenic vessels at the hilus might be useful instead of splenectomy in pernicious anemia and Banti's disease. This assumption is contrary to general surgical experience. In the human being the vascular pedicle of the spleen is so deeply situated that an accurate partial ligation of its vessels is extremely difficult, and dangerous.

An interesting anatomical observation is brought out by Troell, namely, that wide and sturdy transverse communicating branches anastomose the various vessels of the splenic hilum close to the surface of the spleen, in other words, that the vessels do not become terminal until they actually enter the splenic substance. In the course of his animal experiments, Troell found that splenic infarcts did not become infected, even in the presence of a subsequently induced bacteriemia.

Jamison,<sup>1</sup> in experiments on dogs, found that ligation of the splenic pedicle was successful in only 50 per cent. of the cases. In further experiments, he found that covering the spleen with omentum after ligation of both arteries and veins gave uniformly good results in five dogs.

<sup>1</sup> New Orleans Medical Journal, September, 1915.



## GYNECOLOGY.

BY JOHN G. CLARK, M.D.

### CANCER OF THE UTERUS.

**The Cancer Problem.** As we chronicle the advances in gynecology during the past twelve months, it is with the same sense of disappointment as in previous years that we are forced to admit that the cancer problem is still far from being solved. Although the master remedy remains to be discovered, and our knowledge of the etiology of cancer is very superficial, nevertheless, advances have been made in other aspects of the work. The great war in Europe has had an appreciable and limiting effect on medical literature. Many able investigators have ceased working on their own special problems and have turned their attentions to the military side of surgery; hospitals must make room for wounded belligerents; many medical publications have discontinued, others devote their entire attention to medico-military articles, and the postal delivery of practically all of the journals published in the countries at war has been uncertain and unsatisfactory. However, there have been the usual number of new cancer treatments suggested, many of which are of no value whatsoever, while the others, which will be presented for general review, must stand the acid test of time before the critical, serious-minded members of the profession will consider them favorably.

We have always felt that until a certain and sure method of treating cancer in all stages is at hand, the best results were to be obtained by an ever-broadening educational propaganda, both among the profession and the laity, and it is encouraging to note the amount of enthusiasm and energy which have been displayed along these lines throughout the country. It is only by receiving the cases in the very earliest stages that the surgeon can be of real aid in this dread disease and nation-wide education is the surest method of bringing the afflicted people to the surgeon *before they reach the utterly inoperable stage*.

Much credit must be given to the Pennsylvania State Medical Society in furthering the educational propaganda. For years this Society has maintained as a permanent body a Cancer Committee, and through energetic efforts in its own commonwealth, the issue has spread into the nation at large. Through the influence of the Committee, so efficiently presided over by Dr. Wainwright, the medical journals of this country were induced to set aside the July issue of last year especially

devoted to the cancer problem. Sixty-five journals participated in this effort and a very excellent and impressive plea was made in behalf of a more extensive educational movement in favor of the early recognition of this disease. Two years ago the American Society for the Control of Cancer was organized "to disseminate knowledge concerning the symptoms, diagnosis, treatment and prevention of cancer, to investigate the conditions under which cancer is found and to compile statistics in regard thereto," and they are doing work of a very promising character. They maintain a census bureau which is making a distinction between returns based on certain, and on doubtful, diagnosis, and are sending tens of thousands of letters to physicians who have certified deaths from cancer, asking whether the diagnosis was based on clinical findings alone, or was established by surgical intervention, microscopical examination or autopsy. Such work as this is very creditable and is bound to make statistics as such, a much more important factor than has been the case heretofore.

**Results of the Recent Propaganda of Cancer Control.** Although the educational movement in the control of cancer is a very recent one, we are already beginning to see the good results of the campaign. The number of inoperable cases is growing less, the number of precancerous lesions is increasing and there is also a great increase in the number of patients with early cancer. Bloodgood<sup>1</sup> has carefully studied the educational factor in every case which has come under his observation since 1913, and finds that the patients themselves understand the situation better and many of the early cases are referred by other patients; physicians, also, are sending their patients for treatment at a much earlier stage than they did a few years ago. This author warns us that when our patients are educated to seek advice immediately after the first signs, we must prepare ourselves for conditions which we have not seen before and also for diseases with which we are familiar only in the later stages and the clinical picture of which in the early stage may be different entirely. We will see many conditions which before we did not see, because they gave so little trouble and excited so little anxiety that the patient waited for something more serious to develop, and as nothing developed and warnings disappeared, they did not come under medical observation. In this group we must be most particular to avoid unnecessary interference. This educational propaganda on cancer will at first increase the difficulties of diagnosis, but there is no question as to the great improvement of the results if the correct diagnosis is made and the appropriate treatment immediately follows. The *first warnings* of cancer of the cervix or body of the uterus are irregularities in the menstrual flow, especially excessive bleeding; or bleeding or some form of discharge between the menses; or the reappearance of a bloody flow

<sup>1</sup> Pennsylvania Medical Journal, 1915, xviii, 808.

after the menopause. There seems no doubt, however, that these symptoms are associated with many local and general conditions which are not malignant, and do not develop into cancer. Many get well without treatment, but there is absolutely no way of differentiating the benign from the malignant, except by a most careful pelvic examination by an expert and in the majority of cases by the microscopic examination of tissues removed from the cervix and mucous membrane of the uterus by curetting. The interpretation of the microscopic picture is by no means a simple one; nevertheless, if cancer is recognized in this stage, the probability of a cure is the best; we never can get it earlier.

**Responsibility of the Practitioner.** The general principles which should govern our management of incipient cancers of the uterus Reynolds<sup>1</sup> believes will depend, for their execution, on the general practitioner. He should realize that while every irritating or blood-streaked leucorrhea in women in middle life is not necessarily malignant, every such leucorrhea is so far suspicious of malignancy that it must be taken seriously, and demands an examination which should be pushed to the point of showing a satisfactory cause for the leucorrhea. Every erosion or ulceration of the cervix in a middle-aged woman should be regarded as a possible source of cancer and should be treated with prophylactic measures against cancer. Further, all cases of marked increase of the catamenia during middle life should be regarded as suspicious, all cases of intermenstrual flowing, or recurrence of the flow after the menopause as highly suspicious and all cases of intermittent serosanguineous flow as pathognomonic of cancer of the uterus. All of these symptoms are rendered more significant by the coincident existence of enlargement of the uterus, but are not necessarily negatived by its absence. Above all, we must remember that *benign growths of the uterus do not necessarily remain benign.*

**Etiology of Cancer.** As we have stated before, nothing startling has been discovered which can definitely point to the etiology of cancer but certain factors are determined from time to time which tend to strengthen certain views that we may have. In considering human beings, W. J. Mayo<sup>2</sup> states that the evidence as to the relation of chronic irritation to the development of cancer is overwhelming. The woman with myomata of the uterus is many times more liable to cancer of the body of the uterus than women without these tumors; 50 per cent. of the carcinomata of the pelvis and calyces of the kidney are associated with stone in the kidney; at least 20 per cent. of the carcinomata of the sigmoid have their origin in diverticulae; gall-stones are found in at least 85 per cent. of all carcinomata of the gall-bladder, and ulcer or some chronic irritation of the stomach occurs in half of all gastric carcinomata.

<sup>1</sup> Boston Medical and Surgical Journal, 1915, clxxiii, 75.

<sup>2</sup> Journal-Lancet, 1915, xxxv, 339.

**Relation of Cancer to Fuel.** Green<sup>1</sup> found a definite relation existing between the cancer death rate and the type of fuel consumed. Thus, in Northern France, where coal is consumed almost entirely, the death rate is high. In Southern France, where wood is largely used, it is very low, and the death rate in the separate villages varies with the type of fuel consumed. He believes that there is some connection between malignant disease and coal, or its products of combustion, and has worked out some very interesting charts in support of his theory.

**Influence of Dieting on the Course of Cancer.** Much has been written in the past concerning various foods as factors in the causation of cancer, but very little of a scientific nature has been done along these lines until recently. In experimental work upon 130 mice, all of whom had tumors of the breast, Rous<sup>2</sup> underfed half of the animals so that they lost in weight; the other half were full fed, and, by a uniform technic, the growths were removed save for a small bit. The vessels leading to this bit, which was left so as to insure a recurrence, were disturbed as little as possible. In each animal two subcutaneous implantations were made of its own tumor which were to represent disseminations at the time of operations. The feeding was continued as before and the animals kept under observation for five weeks, a period in the mouse's life equal to about three years in that of the human being. The results were striking; during the five weeks, recurrences appeared in 83 per cent. of the full-fed control mice and in only 41 per cent. of the underfed mice who were losing weight at the time of operation. The grafts grew in 68 per cent. of the controls, and in 41 per cent. of the underfed hosts. Evidently restricting the diet has a very marked influence in delaying the reappearance of spontaneous mouse tumors. The treatment was drastic and the best results were obtained in animals losing weight rapidly at the time of operation, the average loss in weight at the end of five weeks' observation was 24 per cent., but the emaciation was less than one would suppose. No cures were effected. In underfed animals again put on a full diet, a rapid recurrence with growth of the grafts was the rule. In the light of this fact, the quiescence of the tumor during the period of dieting can hardly be attributed to processes of resistance. Whether recurrences and the development of metastases in human beings can be influenced by underfeeding, can not be foretold. In a small percentage of tumors in the underfed mice, there was a recurrence with a rapidity unexcelled by any of the tumors in the full-fed animals, so that the end-result of the treatment was a distinct injury, for the host was prematurely emaciated and the development of the growth was unchecked. Therefore underfeeding must not be considered as a palliative treatment of cancer, although, judging from the experimental evidence, it might do good in special cases.

<sup>1</sup> Edinburgh Medical Journal, 1915, xiv, 15.

<sup>2</sup> Bulletin of Johns Hopkins Hospital, 1915, xxvi, 146.

**Influence of the Anterior Lobe of the Pituitary Body Upon Cancer.** Robertson and Burnett<sup>1</sup> have carried on extensive experiments upon rats and have come to the conclusion that the administration of emulsions of the anterior lobe of the pituitary body of the ox, increases very markedly the rate of growth of the primary tumors in rats inoculated with carcinoma. An interesting point in their work was the fact that the growth of small tumors was accelerated relatively more than that of large tumors. This acceleration is only evidenced, however, at a certain stage of the growth of the tumor, subsequent to the twentieth day succeeding inoculation, but there is no evidence to show that the administrations enhance the tendency of the tumors to metastasize.

**Parasitic Theory of Cancer.** In the past there has been intense, and, at times, almost bitter controversy over the tenability of the parasitic theory. Gaylord,<sup>2</sup> however, believes that today, through the discovery of the filterable viruses causing different types of sarcoma in chickens, we may assume that the parasitic hypothesis is at least justified. It is now generally recognized that there are well-defined agencies which work, at least locally, in a predisposing manner. These bring about what may be termed precancerous conditions, and are mechanical, physical, chemical, and infectious in nature. So far as they may be determined locally, they are well summed up as chronic irritation, but it has been shown that, in exceptional cases, the predisposing changes in a tissue are not of a chronic nature, that even a single trauma may suffice; but such cases are exceptionally rare. As a result of the important studies in heredity by Dr. Maud Slye, many believe that there is at least a transmissible predisposition to the development of cancer in mice. With the positive knowledge which we have acquired of certain neoplasms in animals in which the existence of a neoplastic virus has been definitely established, it is no longer possible to believe that there is such a thing as a *single* cancer parasite. We are face to face with the probability that if the various types of cancer are to any great degree caused by such viruses, there are many of them, and probably each one has marked specificity for one type of tissue. The discovery by Peyton Rous of a filterable agent which causes a spindle-cell sarcoma in chickens, and his more recent demonstration of two more types of sarcoma, one a clefted sarcoma with sinuses, and the other an osteochondrosarcoma, each caused by a specific virus capable only of producing that type of tumor and no other, show these three to have a degree of specificity which no one had ever anticipated. The existence of an immunity to transplanted cancer was established by the observations of Clowes, Baeslack and Gaylord, that mice which were inoculated with cancer of the breast sometimes recovered after the tumor had made appreciable growth, and that for a long period after such recovery they

<sup>1</sup> Journal of Experimental Medicine, 1915, xxi, 280.

<sup>2</sup> Journal of American Medical Association, 1915, lxiv, 968.

could not be reinoculated with the same tumor. Further, if the blood of the recovered mouse was mixed with a suitable portion of the cancer to be transplanted, incubated for a period and then injected into an animal, it usually failed to grow. If the interpretation of this observation is correct, it proves the existence of a slight but definite passive immunity. The experiments of Crile and Beebe, with the round-cell sarcoma in dogs, strengthened these observations, these authors showing that if the blood of a dog, recovered from implants of round-cell sarcoma, were transfused into an animal with growing tumors, in many cases a prompt regression with recovery would occur. In this connection it is interesting to note that one of the most effective normal tissues available for setting up a resistance in animals to implanted cancer is the spleen; splenectomized mice being much more susceptible to cancer than normal mice, and splenic extract has been suggested as the proper therapeutic measure in established cancer.

**The Occurrence of Malignant Neoplasms in the Young.** We are all too prone to consider malignant neoplasms as diseases of middle life or old age, so that the statistical work of Warthin<sup>1</sup> may be of some interest and value in correcting false ideas even though it deals with malignancy in all locations. These statistics are based on an analysis of 2000 neoplasms, and the points of interest are that malignant neoplasms are relatively rare before puberty, but there is a steady ascending line of occurrence from childhood onward toward middle life, both sarcoma and carcinoma showing a parallelism of occurrence. The tendency to malignant tumors is relatively slight before sexual maturity is reached, increases during the period of sexual maturity up to the age period of fifty-eight to sixty-two. With the decline of the organism, the tendency to malignant neoplasm decreases. However, of the 2000 cases studied, 195, or 9.75 per cent., occurred before the age of thirty. The series includes 12 cases of carcinoma of the cervix, 2 cases of carcinoma of the fundus and 6 cases of carcinoma of the ovary. One carcinoma of the ovary occurred in the fifteenth year. The earliest carcinoma of the cervix occurred in the twenty-first year.

**Radiotherapy.** Last year<sup>2</sup> I devoted considerable space to reports, chiefly from foreign observers on the radium and Röntgen therapy of carcinoma of the uterus. Nothing in the way of a radical change in the views of these men has appeared in the literature since that time. Schmitz<sup>3</sup> has made a rather extensive review of the literature, as well as the physics of radium and mesothorium, and, from all the available evidence on the subject, concludes that the action of radium and mesothorium is probably the same. In using these substance, the consensus of opinion seems to be that the smallest amount that should

<sup>1</sup> Archives of Internal Medicine, 1915, xv, 444.

<sup>2</sup> PROGRESSIVE MEDICINE, June, 1915, p. 187.

<sup>3</sup> International Abstract of Surgery, January, 1915.

be employed in giving treatment should be 50 mg. of radium element. The alpha and beta rays must be excluded by a metal filter and the secondary rays must be absorbed by a soft rubber capsule enclosing the metal filter. The amount of milligram-hours necessary in the treatment of malignant disease varies from 3000 to 6000 or more, and the action of the rays should be supplemented by the  $\alpha$ -rays. Some foreign observers (Krönig, Bumm) recommend radiotherapy in operable cancers, believing that while in inoperable cases it will frequently cause an improvement in the condition, in operable cases it produces a positive cure. Moreover, the recurrences of cancer are much less amenable to radiotherapy than the primary cancer. In considering the contra-indications to radiotherapy, Schmitz states that they fall under two headings: advance of the "cancer disease" as evidenced by multiple metastases and local extension, and secondly, a leukopenia of 3000 or less and pronounced cachexia.

REPORT FROM KÖLN. Fueth and Ebeler,<sup>1</sup> working in the gynecological clinic at Köln, have divided their cases for the purpose of study into four groups, and report the following experiences: Group 1 consists of operable cases, as far as the local condition is concerned, but in which some constitutional condition contraindicates operation. They have had 11 cases of this sort, most of whom were treated with radium alone. Five of these patients are apparently cured, 4 are still under treatment and there have been no deaths. Group 2 consists of inoperable cases from the standpoint of the local condition and extent of the growth at the time first seen. In 5 cases of this group, the  $\alpha$ -ray was used alone and they all did well for a time, but in every case a recurrence finally appeared and has already caused the death of 4 of them. The other case is still under treatment but is in poor condition. In a sixth case, the  $\alpha$ -ray was used for a time and was then followed by the application of radium. The  $\alpha$ -ray had caused a severe burn, but, following the application of radium, the carcinoma disappeared and complete healing occurred. There were 16 other cases in this group, all of whom were treated with radium from the very beginning. Three of these cases will not be counted because one has been under treatment too short a time and the other 2 have died from extraneous causes. Of the remaining 13, 5 cases are unimproved or have recurred, while 7 cases have been completely healed. One case is well, but the tumor has not quite disappeared, though it is greatly reduced in size. In the third group the authors report on 11 cases to whom prophylactic radiation was given after operation, 8 of them having had uterine cancer, 2 had vulvar cancer and in 1 a papillary cyst of the ovary had been removed. Of these cases, 2 have died from recurrences, 1 is too recent to report while the remaining 8 are completely well. In the final group, the treatment of recurrences

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 14, 217.

is considered and the results are indeed very poor; of 10 cases treated, 5 have died, 2 have not been traced and 1 is too recent to report, but there is nothing encouraging to report from any case.

AN OPINION FROM HALLE. In contrast to the radical views of the gynecologists in Freiburg and Munich, who would subject practically all carcinomata of the cervix, operable or inoperable, to the *x*-ray treatment, Heynemann,<sup>1</sup> who is professor of the Frauenklinik at Halle, still clings to the older and more conservative view of confining radiotherapy to the inoperable cases of cancer and believes that in operable cases the radical operation is the procedure of choice. He admits, however, that many men report results from the *x*-ray treatment of carcinoma that are as good as the results from operation. As a prophylactic measure after operation, he is a firm believer in radiotherapy and insists that all patients operated upon for carcinoma should take *x*-ray treatments at regular intervals for more than a year after the operation, the treatment consisting of large amounts of deep therapy. If the tumor can be treated directly without the rays affecting the surrounding tissue, as in carcinoma of the vulva, vagina and cervix, it should be treated one-half hour daily. In using radium, one may follow the method of Krönig and Gauss which consists in using large amounts, such as 800 mg., or, on the other hand, the method of Bumm, Döderlein and others, which consists in using amounts of radium under 100 mg. may be followed, but Heynemann is of the opinion that a large amount applied for a short time is preferable to a small amount used over a long period of time.

OPTIMISTIC REPORTS FROM FRANCE have appeared on the value of radium as a palliative measure. Degrais and Fabre<sup>2</sup> have had several years' experience with radium treatment and regard it as a most valuable aid to surgery, applied after curetting or partial or total extirpation, or as a preliminary to render an inoperable growth operable. Even in desperate cases, radium may relieve and render the growth tolerable. The benefit from it in cases beyond the scope of surgery gives it a unique position in the treatment of malignant disease. Degrais had a number of cases who seem to be in perfect health, two, three or four years since the cross-fire treatment of their cancers, but he insists on the patients returning at regular intervals, and sometimes he gives another course of treatment. In some cases the radium has been impotent to prevent the return of the cancer, but, on the whole, his results have been satisfactory. He makes a plea for the adoption of the term "Curie therapy" to distinguish this form of treatment from Röntgen therapy since there is a certain amount of confusion in applying *radiotherapy* to all forms of treatment in which radiant energy is used. Fabre

<sup>1</sup> Therap. Monatsh., 1915, xxix, 78.

<sup>2</sup> Ann. de gynéc. et d'obst., 1915, xli, No. 5, by Journal of American Medical Association.

declares that in only about 25 per cent. of the cases of uterine cancer is the growth in a condition so that operative treatment can eradicate the malignant disease. Inoperable cancers, as well as recurrent growths, should be treated exclusively with radium, operative measures in these conditions being only secondary and inadequate. On the borders of inoperability, radium may modify the growth until it can be successfully removed, but in operable cases he still believes that surgery is the treatment *par excellence*, but even here radium therapy is important as it tends to complete the surgical act and ward off recurrence.

THE BRITISH LITERATURE of the past year has contained occasional reports on the subject, which have, for the most part, corroborated the reports from other parts of the world. For example, Morson<sup>1</sup> has been quite well pleased with the results which he has obtained with

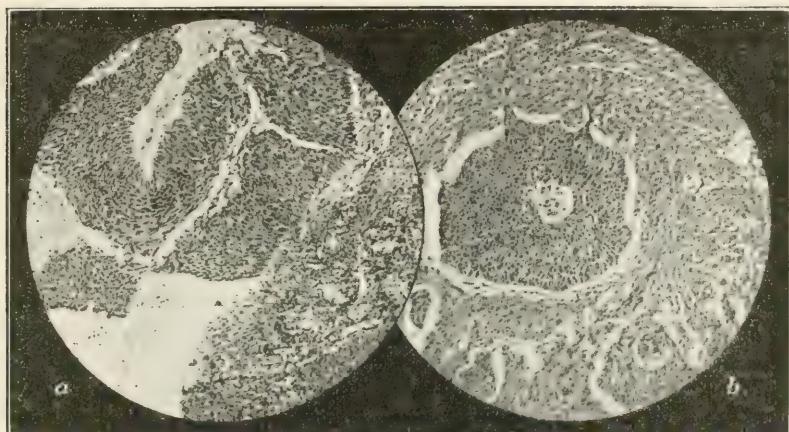


FIG. 90.—*a*, appearance before radium treatment; *b*, appearance of growth two months later, showing proliferation of connective-tissue cells and apparent vacuolation and enlargement of nuclei of malignant cells. (Morson.)

the element in the Middlesex Hospital in London. In many instances, patients who were blanched from vaginal hemorrhage and cachectic from septic absorption on admission, have so improved after radium treatment, that they have been able to return to their daily work, though microscopic examination of the cervix has demonstrated the presence of malignant cells altered from the normal.

*The Length of Exposure.* Experiments carried out on mice have shown that the cancer cell if irradiated with a sublethal dose, has the power to confer immunity against the same strain of tumor. On the other hand, this immunity process is abolished when the cells receive a lethal dose. Basing his work on these experiments, the length of exposure has been gradually diminished so as to cause loss of the

<sup>1</sup> British Journal of Surgery, 1915, ii, 354.

proliferative function of the malignant cell, while ensuring at the same time that a sublethal effect has been produced on the cells at the periphery of the tumor. Thus, in most cases, the length of exposure has not exceeded ten hours. In all the cases dealt with, if more than a single radiation has been applied, at least four weeks have elapsed before the second dose has been given. An important factor which must not be forgotten when a second dose is required, is the increased sensibility of all the tissues to radium rays, so that it is therefore desirable to still further decrease the radium dosage. The effect of exposing the malignant cells to radium irradiation has been carefully determined by Morson by means of microscopic examination of the diseased tissues. The primary effect that is noticed is a rapid degeneration of the malignant cells in the immediate vicinity of the tube of radium. Following this, there is an apparent vacuolation and enlargement of the nuclei of those cells beyond the degenerative zone and the cancer cells lose their reproductive function. About the third day after treatment, the connective-tissue cells commence to proliferate. This action of radium upon the connective-tissue cells shows a similarity to the attempt of nature to arrest the growth of cancer through the new formation of fibrous tissue. If an excessive quantity, or too long exposure of radium be given, not only necrosis of the whole tumor results but the normal tissues slough as well. No evidence has as yet been brought forward to show that diminution in size takes place in the metastases after the removal of the primary growth by radium treatment.

*Complications of Radium Treatment.* In addition to the sloughing which follows the use of an excessive quantity of radium, as noted before, Morson has noted that the great sensitiveness of endothelium to radium has in some instances caused thrombosis of the blood-vessels in the vicinity of the growth. Like other observers, he has seen the treatment frequently complicated by hyperpyrexia which is probably caused by unduly large absorption of dead and dying malignant cells. In some cases there is persistent pain due to the involvement of nerves in the newly formed fibrous tissue. Bone is peculiarly susceptible to radium irradiation, and in cases in which the radium is applied to tissues very close to bone, necrosis sometimes follows.

THE AMERICAN REPORTS ON RADIUM have been rather numerous and, almost without exception, extreme satisfaction is expressed on all sides. As Ransohoff<sup>1</sup> says, "No one who has seen radium used in the treatment of cancer of the uterus can deny its beneficial action at every stage of the disease. The question is, how long does this beneficial action last and in what stage of the disease should it be used? The results in inoperable cancers are little short of miraculous. The bleeding and foul discharges are arrested within a few days, the cauliflower

<sup>1</sup> Lancet-Clinic, 1915, cxiii, 289.

masses, which in some cases fill the vault of the vagina, melt away as by magic."

*Technic.* Schmitz<sup>1</sup> has treated well over 100 cases of malignant disease with radium, nearly half of the cases being pelvic cancers, and has experimented considerably in an effort to determine the best technic of application. In his early work, the duration of each application was from ten to twelve hours, occasionally longer, and the interval between treatments varied from seventy-two to ninety-six hours. Throughout his entire series he has always used the same amount of radium element, this being uniformly 50 mg. The applications were continued until a decided improvement occurred in the subjective, as well as the objective condition, of the patient, which usually took place after a dosage of from 3000 to 4000 milligram hours had been reached. The treatments were then given weekly, and finally biweekly, until the condition of the patient warranted a cessation of the treatments; a total dosage of from 8000 to 10,000 or more milligram hours was thus recorded. Fourteen patients were treated in this manner and a subjective improvement was usually noticed after the third application; the pain decreased, the profuse, purulent, creamy discharge became scanty and serous, and the hemorrhage ceased. After about 3000 milligram hours of radium element had been given, the bimanual findings usually became normal, the uteri becoming freely movable and easily outlined. This knowledge led to the second mode of treatment which Schmitz terms the "intensive method" and consists of applying the radium continuously for from sixty to eighty consecutive hours, thus giving the patient from 3000 to 4000 milligram hours, since he continued to use 50 mg. of radium as a constant quantity. Ten cases were treated by this method, and although the primary results were the same, the apparently objective cure was not reached any sooner than by the first method and, besides, the associated symptoms were exceedingly stormy and much severer, consisting chiefly, in a marked loss of weight, strength and appetite, with hyperpyrexia, obstinate vomiting, profuse diarrheal stools and obstinate dysuria. Although these symptoms were only transitory, lasting from eight to ten days, the patients suffered much, a condition which was rarely observed in cases treated by the first or "intermittent method." Inasmuch as this "intensive method" was obviously unsatisfactory, Schmitz finally adopted the following plan of treatment, which was pursued in the remainder of his cases: A course consists of from six to eight seances of from ten to twelve hours each, with an interval of from thirty-six to sixty hours. This course is followed by an intermission of three weeks. If a bimanual examination made at this time reveals an apparent cure, two or three applications of from 500 to 600 milligram hours of

<sup>1</sup> Journal of American Medical Association, 1915, lxv, 1879.

radium element are given every second or third day. Another interval of three weeks is allowed, and, if the examination then reveals a normal condition, the treatment is considered terminated. This "interval method" gave the best subjective and objective results with a minimum of concomitant symptoms, so that it is the method of choice.

The work of Kelly and Burnam with radium has undoubtedly been the most extensive in this country and they feel that while our knowledge of the curative action of radium on cancers of the uterine cervix and vagina is yet in its infancy, nevertheless its ultimate possibilities, viewed in the light of present experience, seem very great, since it is already evident that it greatly increases the percentage of curable cancers and correspondingly diminishes the percentage of the incurable cases. At the meeting of the American Medical Association in June, 1915,<sup>1</sup> these authors presented a report based on a series of 213 cases of cancer of the uterine cervix and vagina treated with radium. Of the 213 cases, 14 were operable and 199 inoperable or inoperable recurrent cancers. Treatment was refused to no inoperable case that came to the hospital, although they discouraged the coming of patients with evident general carcinomatosis. They have divided their cases into three groups for the purpose of the report:

1. Operable cancers, meaning those still confined to the cervix or only moderately involving the parametria and vaginal walls. They are not fixed to the pelvic wall on either side and have not caused hydronephrosis and are not associated with pelvic pain.

2. Inoperable cancers, meaning those associated with general metastases, those firmly fixed to one or both pelvic walls; those extensively involving the bladder, vagina or rectum; in short, cases of the type that operation has never cured.

3. Recurrent inoperable cancers, meaning recurrences following operation such as they have never cured except by radium. In recording their results, they state that *clinically cured* means the complete disappearance of the cancer so far as palpation, curettage or other method may disclose, associated with the apparent perfect general health of the patient; *improved* refers to a definite betterment of the patient's condition such as cessation of the hemorrhage and discharge, or a disappearance of pain which has resisted all the drugs, including morphin; *unimproved* means that no material benefit was produced by the treatment.

*Results.* All of the cases included in the report were investigated one month before the report was presented, and the results show that, of the 14 operable cases, 10 were operated upon and treated prophylactically with radium. Of these, 2 have been well for more than three

<sup>1</sup> Journal of American Medical Association, 1915, lxv, 1874.

years, 1 for more than two years, 4 for more than a year, and 3 for more than six months. The number is too small to draw any conclusions but yet is suggestive, when we consider that in 75 per cent. of all cases with operation there is a recurrence, and that 60 per cent. of these recurrences take place within one year following operation. In 4 cases of this operable group, on account of some general contraindication to operation, radium alone was used; they are all living and well, 2 for over three years and 2 for over one year.

*Inoperable Cases.* The total number of inoperable and inoperable recurrent cases is 199, of which 53 patients have been clinically cured, 109 markedly improved and 37 not improved. The series includes 35 cases of originally inoperable cancer of the cervix uteri or vagina in which the patients are clinically cured, in 2 cases for over four years, in 2 cases for over three years, in 4 cases for over two years, in 17 cases for over one year and in 10 cases for over six months. It also includes 18 cases of originally inoperable recurrent cancers in which the patients are now clinically cured over periods varying from six months to six years. Excluding the cases operated upon, therefore, there were 203 cases treated, of whom 57 are clinically cured. As a result of these experiences, Kelly and Burnam are convinced that radium is of exceedingly great value in the treatment of cancers of the cervix, uteri and vagina, and they expect that the results in the next two hundred cases will far surpass those reported here. Even in the cases in which radium has not effected a cure, the improvement is so marked that it alone makes radium a great addition to existing methods and would justify its use, and they believe that every inoperable cancer of the cervix or vagina, provided general metastasis is not evident, stands a chance of at least one in four of cure by radium treatment, and, further, that in operable cases, the joint use of radium and operation may raise the chance of cure to three in four, or even better. In brief, their views in regard to operation in these cases are to advise hysterectomy and radiation in all clearly operable cases. In borderline cases, however, they advise the use of radium, as the permanent cures from operation are not numerous in this group. If the growth does disappear, it can only be determined whether hysterectomy is advisable or not, by trying out both methods; this as yet has not been done in a sufficient number of cases to arrive at any definite conclusions, but they feel that when clinical cures have occurred in inoperable cases, operations are probably best not carried out. If, on the other hand, an inoperable case becomes operable, but does not entirely heal, then the case should be treated by operation.

**Röntgen Therapy.** Since the wave of enthusiasm over radium therapy has become so marked, the treatment of malignant disease of the uterus by the  $\alpha$ -ray seems to have been relegated to a place of secondary importance. The recent advances in Röntgen therapy have been reviewed

by Stern,<sup>1</sup> who states that the factors of most importance in increasing the efficiency of the rays in the treatment of advanced malignant disease depend upon three basic principles. First, by passing the rays through an aluminum filter, the soft rays are filtered out, thereby increasing the penetrability of the hard rays. In deep-seated lesions, a filter 3 mm. thick should be used. Secondly, cross-fire administration should be employed, which consists of attacking the lesion from all directions, changing the position of the tube from time to time so that a larger amount of raying may be given by having a greater area of skin surface to work upon without the danger of burning any one particular location. We may use two, or even three, tubes at the same time, as, for example, in carcinoma of the uterus we may use two tubes over the abdomen and one tube over the vagina. Thirdly, massive doses should be given instead of giving repeated fractional doses until an erythema is produced, with the possibility of a severe dermatitis to deal with in addition to insufficient dosage. Instead of all this, Stern recommends giving one massive carefully measured dose up to the point of tolerance of the skin and waiting until the effect of this dose has worn off before repeating. In Krönig's clinic, the skin over the abdomen is dissected back in flaps, and an almost incredible amount of rays poured into the wound without causing any dermatitis. The vaginal mucous membrane is extremely tolerant to the *x*-ray, and, by carefully protecting the outside skin, one can give daily treatments through the vagina, lasting for hours each time, continued indefinitely for weeks, without producing even the slightest dermatitis; in fact, the only limit to the duration of these treatments is the time at the operator's disposal and the ability of the patient to remain, in a rather uncomfortable position. Despite the advances in Röntgen therapy, Stern distinctly emphasizes that it is to be reserved for inoperable cases, recurrences, and for prophylactic treatments following operation.

**Other Non-operative Methods of Treating Cancer.** THE PERCY TREATMENT. Last year<sup>2</sup> we referred to the treatment of inoperable carcinoma by means of *heat* as originated and practised by Percy. Since that time, this method has received considerable attention and very favorable comment by all of the surgeons who have followed the technic closely. Percy gave a very interesting talk upon his method at the last meeting of the Pennsylvania State Medical Society in Philadelphia on September 23, 1915, and on the following day demonstrated his method in one of the local hospitals. From this demonstration, as well as from Percy's recent literary presentations,<sup>3</sup> we have been able to gather some important points which were not presented last year.

<sup>1</sup> Medical Record, 1915, lxxxvii, 221.

<sup>2</sup> PROGRESSIVE MEDICINE, June, 1915, p. 212.

<sup>3</sup> Boston Medical and Surgical Journal, 1915, clxxiii, 93; American Journal of Obstetrics, 1915, lxxii, 298.

He objects strongly to the treatment being classed as a cauterization as the average person gets entirely the wrong impression of the object to be attained when the word *cautery* is used. To the novice in the application of this technic, one of the surprises in its application is the slowness with which the heat penetrates the cancer mass, requiring from twenty to forty minutes before an appreciable degree of heat is felt in the involved organs. This frequently leads the operator, unfamiliar with the proper way of applying the technic, to turn on more heat, which merely causes charring of the tissues, forming a carbon core which does not transmit the heat very well, then more heat is turned on until the degree of heat used reaches a dangerous point. To illustrate the proper degree of heat to be used, Percy states that when cotton is wrapped around the heated cautery, it should not even change color. The curette should never be used before applying the treatment, even to get a portion of the diseased tissue for diagnostic purposes; when the tissues are thoroughly permeated by the heat, the cells are fixed in such a way as to become immediately available for sectioning and staining without the further use of the usual hardening fluids. At the same time, the heat seals at once the lymphatic and bloodvessels, preventing the further dissemination of the cancer and mixed infection. In addition, the immediate nerve supply is cut off, thus explaining the freedom from shock and local pain which is the rule following this treatment. It is not part of the technic to remove any of the pelvic sutures which are the seat of cancer. The exception to this statement is that both ovaries are removed; first, to limit the blood supply, and second, to bring on the menopause where it has not yet occurred. If this is not done, a torturing form of menstruation may occur for a few periods from the cervical stenosis which occasionally follows the application of the heat. The most distressing class of cases to treat are those in which recurrences follow a panhysterectomy because there is no exuberant mass to use as kindling in order to develop heat. When recurrence follows a total hysterectomy, it is usually of the infiltrating type and the invaded tissues left after the hysterectomy are not of sufficient thickness to permit of the development of a degree of heat necessary to kill the carcinoma cells. If a cauterizing temperature is used, it cannot be regulated and the result is a distressingly destructive effect which will probably destroy the most important part of the urethra or make a hole in the bladder. In order to overcome this lack of tissue in recurrent cases, Percy has tried filling the vagina with tightly bound beef mass, in which, with an apple corer, a hole has been made for the heating iron. In this way he has succeeded very well in irradiating heat through the vaginal walls to the degree that is destructive to the cancer cells.

*Technic.* The technic of the treatment as practised by Percy may be briefly outlined as follows: The abdomen is opened and the extent

of metastases determined and the internal iliac arteries are ligated after packing off the intestines, or, if this is difficult to do, the uterine arteries are ligated as near the pelvic wall as possible. When high degrees of heat are used, late hemorrhages are rare, but with the low degree of heat used in this method, they become more frequent. It is an advantage therefore, to tie all the pelvic blood supply in order to aid in the starvation of the tissues which might otherwise become involved in the malignant process. This is accomplished by ligating the internal iliac arteries and removing the ovaries and since doing this, Percy has had no hemorrhages, whereas before this was part of his technic,

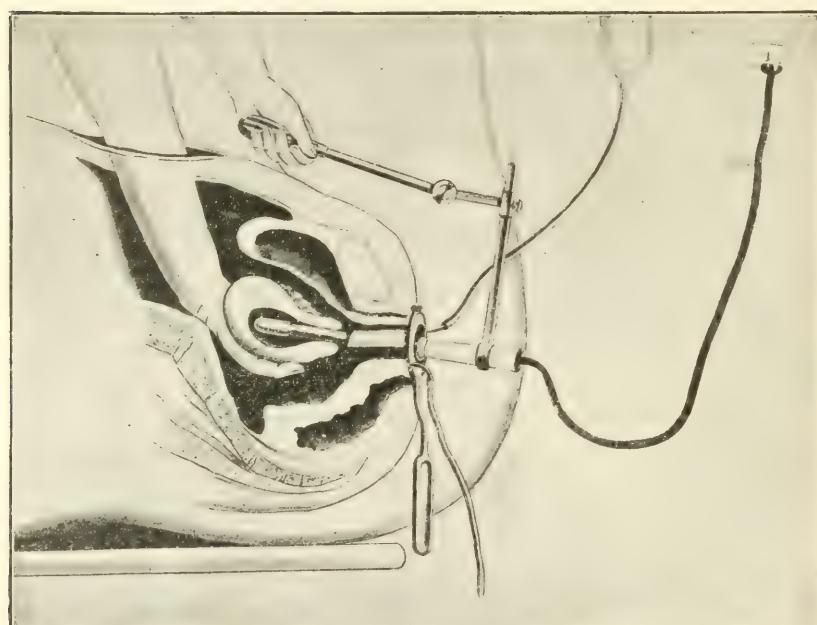


FIG. 91.—Diagram showing hand in abdomen guiding the application of the heat. (Percy.)

hemorrhages occurred in 2.5 per cent. of his cases, usually about two weeks after the operation, and caused the death of four patients. The vagina is then dilated and a water-cooled speculum inserted. The heating iron is introduced through the speculum to the fundus of the uterus and held there until everything abnormal is too hot to hold in the hand of the assistant, encased in a medium weight rubber glove. If the heating iron is moved aimlessly about, no area will become sufficiently heated to destroy the carcinoma present. After the heat has penetrated the uterus to the desired degree, the heating iron is moved to a new position and the procedure repeated. This is continued until all of the pelvic tissues are *freely movable*, the complete seance sometimes

lasting several hours, but the patient requires only the very lightest anesthesia. After the treatment there is usually an offensive discharge for about two weeks and uterovesical and uterorectal fistulae occasionally result from the treatment, but they usually heal spontaneously, but when the fistula is in the vagina, it is often a difficult matter to secure closure. In about 50 per cent. of the cases, a reapplication of the heat is necessary. In 2 cases Percy has repeated the treatment five times, but the abdomen must be opened at each application and

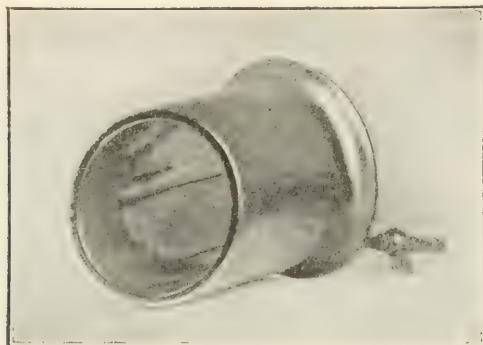


FIG. 92

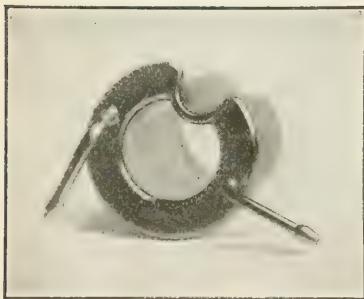


FIG. 93

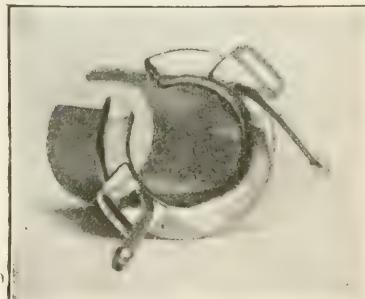


FIG. 94

FIGS. 92, 93, and 94.—Cooled water specula. (Percy.)

the hand inserted in order to determine the amount of heat required. Percy insists that a secondary radical operation should not be performed even if the case seems to be operable, as nothing is to be gained thereby, but, instead, the cicatricial tissue is broken down, and this may be the starting point of a recurrence, inasmuch as nature's defense is removed. It must be remembered that the majority of the cases which Percy has treated are of the utterly hopeless type, most of whom have been refused operation by other surgeons, so that a cure in any of these cases is of great significance.

At the Mayo Clinic the Percy method has been employed since January, 1914, and while sufficient time has not elapsed to give any definite reports, Balfour<sup>1</sup> states that the immediate results in 31 cancers of the cervix which they have treated have been most satisfactory. All of the cases were too far advanced to permit of any primary radical operation, but in every case there was a cessation of the discharge and bleeding immediately following the treatment, along with a corresponding improvement in the general condition. The majority of the patients were reexamined between six weeks and three months after the treatment and the uterus was found freely movable, with an atrophic, smooth, clean cervix and vaginal vault. Regardless of how favorable the results may appear to be, he believes that if it becomes technically possible and there are no logical contraindications, a secondary total hysterectomy should be done. This has been done in 9 of Balfour's cases and in 5 of these the pathologist has been unable to find any evidence of malignancy in the specimen removed, but, nevertheless, the uterus must be considered potentially malignant.

**THE COMBINATION METHOD: PERCY TREATMENT FOLLOWED BY OPERATION.** There is a feeling among many surgeons that if the Percy treatment causes an inoperable cancer to become operable, there should be no hesitation in performing a radical hysterectomy in spite of the fact that such a procedure is in direct contrast to Percy's teachings. Clark<sup>2</sup> and Gelpi,<sup>3</sup> of New Orleans, have been the chief advocates of this combined method. They believe that while the technic of Percy possesses many admirable qualities, when used in the light of a cure, it is not a method to be singly used, but should be classed as a *valuable adjunct* and its chief virtues are to be witnessed when combined with other equally valuable but operative methods. Clark believes in ligating both internal iliacs and one ovarian artery, since in this extensive ligation, twenty-five arterial trunks are shut off, the uterus receives only a limited supply of blood through the one ovarian and the resulting starvation produces a marked retarding influence over the growth. Besides, while the iliacs are being tied, the angle of the bifurcation of the common iliac can be explored for lymphatics, which, when removed, are a valuable prognostic guide as to the advisability of further subsequent radical operation. As a preliminary hemostatic for primary or later Wertheim removal, it notably controls operative hemorrhage, and, further, as a result of these ligations, the slough seems to detach sooner and the vault of the vagina clears more rapidly.

*Classification.* In incipient cases, where the ulceration is strictly limited to the cervix and the uterus is freely movable, the application of heat and the Wertheim removal are combined at one sitting. In

<sup>1</sup> Journal-Lancet, 1915, xxv, 347.

<sup>2</sup> Journal of American Medical Association, 1915, lxv, 1171.

<sup>3</sup> New Orleans Medical and Surgical Journal, 1915, lxviii, 151.

extremely obese women of small stature, it is a physical impossibility to operate radically; furthermore, if it were possible, the primary mortality would be so high as to render the procedure unwise. Here the liberal application of heat offers the best and only chance. In cases in which the cervix is well infiltrated with carcinoma and the growth is beginning to spread to the vaginal walls, but in which the uterus is still movable, the Percy method is applied, and, after an interval of from three to four weeks, these surgically doubtful risks are transformed into safely operable cases and are then subjected to the

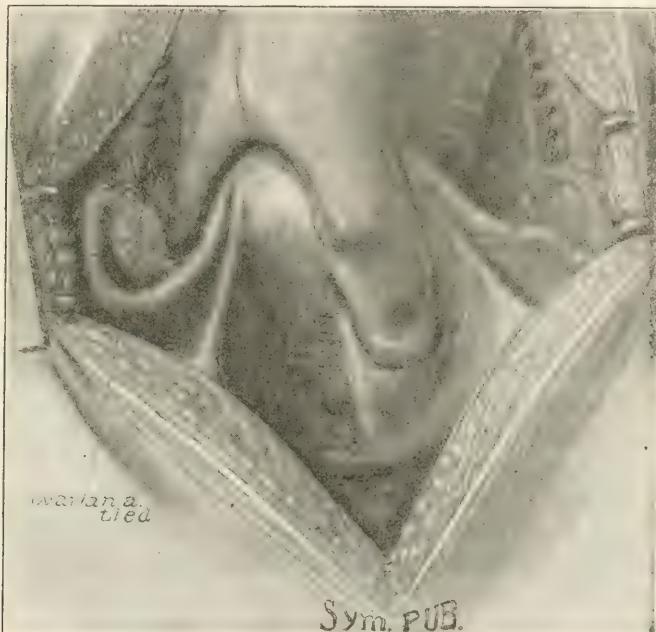


FIG. 95.—Ovarian artery tied and peritoneum closed over ligated internal iliacs. Hand grasping uterus with fingers extending down around basal structures to guide Percy cautery and control heat. Cautery schematically shown embedded in lower half of uterus inserted by vagina. (Clark.)

radical operation. In cases in which there is a carcinomatous crater or cauliflower mass in the vault of the vagina with notable infiltration in the surrounding tissues, surgery being out of the question, although permanent relief is not to be expected from any method of treatment, the application of heat may give much genuine comfort and occasionally some *cures*. Even in this group, while exploring the abdomen, if the glands are negative and the large mass is believed to be partly due to a chronic infection, the woman is allowed to transform and subsequently is given the benefit of a radical operation. In the hopelessly advanced class of cases, in which there are conglomerate metastases of the bladder,

rectum and vagina, Clark believes that more harm than good follows any attempt at local interference and he does not even apply the heat alone in cases of this type. He has treated 42 cases of uterine cancer by the combination method and has not had a single primary death following the ligation and heating, or from the Wertheim removal.

CHEMOTHERAPY. Within the last three years<sup>1</sup> a number of reports have appeared in the medical press which bear on the treatment of malignant growths in human beings by chemical preparations. The most persuasive and insistent claims have been made in connection with the colloidal solutions of certain metalloids and metals notably *selenium*,<sup>2</sup> *vanadium* and *copper*.<sup>3</sup> It is safe to assert that the application of chemotherapy to the treatment of tumors practically dates from the publications of Wassermann.<sup>4</sup> He stated the principle that a rational therapy of tumors must be based on constitutional treatment, since local treatment can have only local effects. The lymphatic extension of tumorous growths and the often unsuspected metastases in distant organs, must of necessity escape the effects of purely local treatment. Hence, Wassermann reached the conclusion that all treatment of cancer which was to be effective and not merely palliative, must be carried to all parts of the body by means of the blood stream. He therefore introduced the use of intravenous injections in the experimental therapy of rat and mouse tumors. Weil<sup>5</sup> has reviewed the subject rather carefully and states that Wassermann's original presentation gave few experimental details, and has not been followed by the promised scientific report, but later reports show that by far the larger proportion of animals perished during the treatment in the stage of softening, so that a cure was accomplished in from only 3 to 5 per cent. of animals. The reason for this is that the therapeutic dose of these compounds is considerably greater than one-half of the toxic dose, and the tumors failed to be influenced unless the dose given fell very little short of the fatal amount. Moreover, in order to accomplish a complete cure, at least eight to ten injections must be given and, in some instances, not less than fourteen. It is quite clearly established, Weil believes, that none of the preparations of which the therapeutic effectiveness has hitherto been proclaimed, exercise any direct influence on the life and growth of the tumor. Under certain restricted conditions, however, they appear to produce certain changes in the tumors and in a small proportion, even cures. These results occur only in subcutaneous tumors which are not smaller than a cherry pit in size. Many investigators have worked with colloidal selenium and the results obtained by them have been fairly concordant: The intravenous injection of the preparation produces but slight disturbance; there is leukocytosis, a moderate rise in

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1915, p. 209.

<sup>2</sup> Ibid., 1914, p. 210.

<sup>3</sup> Ibid., June, 1913, p. 190.

<sup>4</sup> Ibid., June, 1912, p. 170.

<sup>5</sup> Journal of American Medical Association, 1915, lxiv, 1283.

temperature and not infrequently a chill, otherwise the substance seems to possess no toxicity. The effects produced on the tumors have almost invariably been described as encouraging, the surface of the tumors, if ulcerated, became cleaner and healthier, the tumors became softer, the rate of growth became arrested and there was relief of pain and of the accompanying functional disturbances; there was often a gain in weight and an improvement in the general well-being. The compounds of selenium on the market include Walker's sulphoselene and seleniovanadium. Colloidal silver, under the names of electrargol and fulmargin have also been introduced. In brief, the demonstrable reduction in the size of the tumor, of a kind not to be attributed to the natural processes of evolution of that tumor or of its associated lesions, is the one essential feature of effective therapeutic intervention.

**COPPER SULPHATE TREATMENT.** Manara<sup>1</sup> gives a number of views of the microscopic findings in a case of cancer of the cervix in a woman aged forty-nine years. They show the varying aspect of the pus and scrapings from the cancer during a course of copper sulphate treatment, with final cure and no signs of recurrence during the months that have elapsed since. The woman had refused an operation and the treatment was merely a daily intramuscular injection in the buttocks of a 1 per cent. solution of ammoniacal copper sulphate in distilled water. He states that the glycogen in the neoplasm transforms the copper sulphate reaching it into copper oxide. Under the caustic action of this copper oxide, the cancer tissues swell and break down into an amorphous mass. This arrests the growth of the cancer which thus becomes transformed into an afebrile, mild inflammatory process which gradually heals. The course of these changes can be traced in the microscopical findings reproduced in the typical cases reported, all of which confirm his previous announcements on the subject. Cancer elsewhere than in the uterus is less protected from injury from without or digestive juices, etc., so, to date, he commends the copper sulphate treatment only for uterine cancers.

**BEEBE'S AUTOLYSIN TREATMENT.** Considerable discussion and comment has been occasioned during the past year, both in the medical and lay press, over the "Autolysin" treatment of malignant disease, which was originated by Alex. Horowitz, an Austrian biologist and chemist, and is being championed in this country by Beebe.<sup>2</sup> The treatment consists of the application of a poultice to the affected part and the internal administration of a pill or liquid extract of the ingredients of the poultice. The application of the poultice causes marked irritation of the skin, the tumor becomes edematous and soft, and, if

<sup>1</sup> Polyclinico, 1915, xxii, No. 10, by Journal of American Medical Association.

<sup>2</sup> New York Medical Journal, 1915, ci, 981.

the skin is broken, there is a discharge of broken-down cancerous material, serum and leukocytes. At the same time, the general condition of the patient improves as evidenced by relief from pain, increase in appetite and marked improvement in the cachexia. Subcutaneous injections have to a considerable extent displaced the poultice and at first the injections were made directly into the growth; later, however, the injections were made at a distance from the growth, in the arm, and gave the same result. Some of the patients had  $\alpha$ -ray treatment in addition to the injections, but the effects of the treatment in them were better than in the cases treated by the  $\alpha$ -ray alone. The powder used to form the poultice or pills is composed of the seeds, roots, barks and flowers of Menyanthes trifoliata, Melilotus officinalis, Mentha crispa, Brassica alba, Anemone hepatica, Viola tricolor, Anthemis, Fructus colocynthidis, Lignum quassiae, Urtica dioica, Radix rhei and Hedge hyssop. Any enthusiasm which may have arisen over the encouraging reports of Beebe must surely have been extinguished by a later report on the subject by Weil<sup>1</sup> of the General Memorial Hospital of New York, who had general supervision of the clinical activities of that institution while Dr. Beebe was trying his treatment there. He states that 23 cases have been treated in the wards of the hospital by Dr. Beebe with autolysin. Of these 23 cases, 14 patients died in the hospital and 8 were discharged unimproved. Only 1, to the best of his knowledge, is at the present time in a condition which could be described as an improvement on that presented at the time of admission to the hospital. Although the treatment affects the size of the mass, it does not in the least degree impede the steady and relentless progress of the malignant growth. Moreover, there is another set of results of which no mention is made in Dr. Beebe's first article and a very inadequate description in the second. A fairly large proportion of the patients, certainly over half, were most unfavorably affected by the local injections. The pain of the injections was not infrequently so severe that the patients refused to accept, or the interne to administer, the treatment. The consequent swelling was at times so marked as to give great distress, and in two instances the treatment appeared to be responsible for an almost fatal hemorrhage. The general effect on the health and nutrition in many cases appeared to be so deleterious as to indicate the cessation of the treatment.

**Surgical Treatment of Uterine Cancer.** Cobb<sup>2</sup> reports on a series of 420 cases of cancer of the uterus coming to the Massachusetts General Hospital between the years 1900 and 1914, only 36 per cent. of which were operable. He advises performing a preliminary functional renal test several times and, unless 25 per cent. excretion is recorded, he abandons operation. All cases in which a radical hysterectomy is to

<sup>1</sup> Journal of American Medical Association, 1915, lxv, 1641.

<sup>2</sup> Boston Medical and Surgical Journal, 1915, clxxiii, 85.

be considered should have the Percy method used to a certain extent before the operation, but should never be curetted. The operation itself should be performed just as soon as possible after the Percy treatment, that is, just as soon as the offensive vaginal discharge has disappeared. Before beginning the operation, he fills the vagina with tincture of iodine and allows it to remain for two minutes; it is then wiped out with gauze and the vagina is filled with alcohol, which is later washed out with bichloride solution. He uses combined spinal and ether anesthesia and believes that in this way the operative shock is reduced, by following the principles of Crile's anoxic-association. The incision should reach from the umbilicus to the symphysis pubis, cutting partly across the tendinous insertions of the recti muscles, if necessary, to make more room. The incisions in the recti are closed at the completion of the operation by a few mattress sutures and give no further trouble. In order to avoid damage to the blood supply of the ureters and consequent sloughing and fistula formation, he has devised an original method of handling the ureters. After the ovarian artery has been ligated and the broad ligament opened, the peritoneum being divided above the bifurcation of the iliac arteries, the ureter is exposed lying on the inner and posterior flap of the broad ligament. The internal iliac artery is exposed and ligated with chromic catgut, after which the posterior layer of the broad ligament is incised below the ureter, midway between the bifurcation of the iliac artery and the uterus, parallel with the uterter and about one-half to three-quarters of an inch away from it. Through this slit, tapes are passed, wet with normal salt solution, surrounding the ureter. Traction on the tapes serves to roll a cuff of peritoneum about the ureter and by using this method, Cobb has never had the formation of a ureteral fistula, although he has made strong traction on the tapes. The statistics that he presents are based on 31 radical hysterectomies, all of which have been traced. He had an immediate mortality of 5, or 16.1 per cent.; he operated on 6 patients over five years ago, of whom 5, or 83 per cent., are alive and free from recurrence and 10 patients are alive and well after three years.

**The Importance of Destroying the Cervical Mucosa in Subtotal Hysterectomy as a Cancer-preventing Measure.** In order to ascertain the frequency of cancer developing in the cervical stump following a subtotal hysterectomy, Tyler<sup>1</sup> sent a questionnaire to four hundred surgeons throughout this country, of whom one hundred and twenty-three replied, reporting 75 cases. To this number Tyler adds 25 cases collected elsewhere and adding these to the 114 cases previously reported, brings the total number above 200.

The first question asked was "What is your treatment of the cervical mucosa in sub-total hysterectomy?" The replies showed that 22 per

<sup>1</sup> Southern Medical Journal, 1915, viii, 583.

cent. excise the mucosa, 13.5 per cent. use the cautery, 3.4 per cent. excise or cauterize, 3.4 per cent. prefer total hysterectomy in all cases, 12.7 per cent. use carbolic acid or tincture of iodine, 1.05 per cent. use the curette, and 44 per cent. do nothing. Another question asked was "Do you think destruction of the cervical mucosa will prevent cancer in that cervix?" Some men thought that the destruction of the mucosa would prevent cancer, others thought that it would not prevent the squamous-cell variety, while still others did not believe that it would have any effect on the subsequent formation of cancer. The replies indicated, however, that more surgeons are performing a total hysterectomy than formerly. Personally, I have used the cautery for ten years and have never seen a case of cancer of the stump appear after its use.

**Complete Removal of Cancer by Curettage.** In addition to the 19 cases already reported in the literature, Ladinski<sup>1</sup> reports 3 cases of his own in which a cancer of the body of the uterus was removed *in toto* by the curette. Of the entire series of 22 cases, 10 were instances of carcinomatous degeneration of uterine polypi, and in the remainder the growth developed in the uterine mucosa. In 18 cases the uterus was subsequently removed, while in the remaining 4 radical operation was not performed, in 2 because the patients refused operation, in 1, the attempted extirpation was not completed on account of hemorrhage and in the fourth because the surgeon advised against it. The patients in whom no extirpation was done remained well from one to four years, and, in all the cases cited, the prominence of the authors who made the studies and reports precludes any possibility of a mistake in diagnosis or a mix-up in the slides. That a carcinomatous growth can be entirely removed by the curette when it is limited to a uterine polyp, or when it is confined to the mucosa, is proved beyond any question of a doubt by the cases cited. Moreover, Schottländer believes that a young carcinoma can also be removed by the curette when there is penetration of the muscular wall. That there are so few cases of this type reported, Ladinski believes is due to the fact that, in the first place, diagnostic curettage is not resorted to often enough, and, further, if carcinoma is diagnosed from the scrapings and subsequent removal of the uterus fails to show any growth in the corpus uteri, the fact is attributed to a mistaken diagnosis in the curettings. Granting that these cases are cured by the exploratory curettage, we must not accept this as a method of treating cancer, but should remove the uterus in every case, and, above all, the laity must not be allowed to obtain the idea that cancer of the uterus can be cured by a simple curettage, as they would undoubtedly refuse the major operation in every case.

**Chorio-epithelioma Simulating Ectopic Pregnancy.** During the past year 2 very interesting cases were reported in which a chorio-epithelioma

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 325.

perforated the uterus, causing clinical symptoms which led to a diagnosis of ruptured ectopic pregnancy in each instance. The first case, which was reported by Outerbridge,<sup>1</sup> was that of a young married woman who was curetted in October, 1913, for a supposed incomplete abortion. Following this, she had irregular menstruation for a few months and then the menses became regular for a few months, but in the summer of 1914 they again became irregular. Styptics controlled the bleeding and in September, 1914, she thought that she was pregnant. She missed her period in October, but a few days later was suddenly seized with a violent abdominal pain which caused her to faint. An examination at this time disclosed an extremely tender, rigid abdomen, with a tender mass distinctly palpable in the vaginal vault, so that a diagnosis of ectopic pregnancy was made and operation performed. The pelvic cavity was found full of blood, both free and clotted; the tubes and ovaries were normal, the uterus was enlarged and presented in its fundal region two small nodular excrescences, each about 1 cm. in diameter, one of which was eroded, the overlying serosa lacking and through which a probe could be passed deeply into the uterine wall. A rapid supravaginal hysterectomy was performed and, on section of the uterus, there was found a tumor at the fundus measuring 3 x 2 cm., communicating with the erosion on the external surface. The uterine cavity and endometrium were entirely uninvolved, which explains the absence of external hemorrhage. Microscopic examination of the growth showed a characteristic chorio-epithelioma. The patient fully recovered from the operation. Outerbridge believes that the origin of the tumor can be explained by the supposition that a bit of chorionic epithelium was originally swept into a vein in the thickness of the uterine wall, and, having been arrested, underwent development at that point.

The second case was reported by Hyde,<sup>2</sup> before the New York Obstetrical Society. This case was that of a middle-aged Italian woman who was admitted to the hospital on October 23, 1914, suffering from profound shock—pulseless, restless and with sighing respirations. Her last menses had occurred on August 23, and since that time she had been nauseated and complained of constant pain in the lower abdomen, more marked in the left ovarian region. On the day of admission to the hospital, while walking upstairs, she was suddenly seized with a severe pain in the lower abdomen followed by collapse. Here again a diagnosis of ectopic pregnancy was made and she was rushed to the hospital. Abdominal examination revealed a very tender and tympanitic abdomen, the pulse could not be counted, the temperature was subnormal and the respirations were increased and sighing. Vaginal examination revealed a large cervix in good position, but exquisitely sensitive to

<sup>1</sup> American Journal of Obstetrics, 1915, lxxi, 504.

<sup>2</sup> Ibid., 967.

motion in any direction. The uterus was the size of a three-months' pregnancy, movable, but giving pain on motion, and in good position. Both lateral fornices were very tender, but nothing definite could be mapped out in the nature of bogginess or a mass. At operation, the abdomen contained a large amount of free blood, both tubes were normal, but there was a rent in the posterior uterine wall about 5 cm. in length on the left side below the left cornu and from which there was a free and copious hemorrhage. Hysterectomy was clearly indicated, but the general condition of the patient was so poor that the rent in the uterus was sutured and the abdomen closed. The patient died in twenty-one hours in profound shock, never rallying from the operation. At autopsy, it was discovered that the whole left side of the body of the uterus above the internal os was the seat of a tumor mass which had perforated the uterine wall, giving rise to the symptoms noted. The pathological report on the tumor showed it to be a chorio-epithelioma. Before the death of the patient, it was learned that she had been curetted about sixteen months before her admission for a hydatid mole, but this information was not obtained in time to aid in making the diagnosis.

#### NON-MALIGNANT CONDITIONS OF THE UTERUS.

**Radiotherapy.** In the treatment of non-malignant conditions of the uterus by means of radium, Kelly<sup>1</sup> and Burnam<sup>2</sup> have had an experience as large, indeed larger, than their experience with radium in the treatment of cancer of the uterus. They state that the most striking effect of radium in gynecology is in its certain CONTROL OF EXCESSIVE UTERINE HEMORRHAGE due to METROPATHIES or disturbed ovarian functions. While palliative operations, particularly curettage, gave temporary relief, permanent relief is, as a rule, only obtained by hysterectomy. The use of radium offers a far safer and simpler procedure. Usually a single application into the uterine cavity of 300 mg. for three hours causes a permanent amenorrhea. A second application can be given in six weeks if the first fails in the desired result. These patients pick up rapidly, suffer no inconvenience and in more than 50 per cent. of the cases are free from menopausal symptoms. In very young women, by giving a large treatment over a short period of time, it is possible to avoid amenorrhea and still render the menstruation normal in type so far as duration and loss of blood are concerned. It is only the very occasional type that has to be treated to complete amenorrhea to secure a perfect restoration to health.

In the treatment of PRURITUS AND KRAUOSIS VULVÆ, two or three

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 271.

<sup>2</sup> Bulletin of Johns Hopkins Hospital, 1915, xxvi, 190.

mild applications of radium cause the itching to cease and the skin to return to normal in a truly astonishing manner.

The HEMORRHAGE associated with FIBROID TUMORS is also readily controlled by the application of radium and the tumor itself will either disappear or become greatly reduced in size in all but 5 per cent. of the cases. In fact, they believe that radium is the method of choice in treating fibroids of the uterus, and operation should be limited to cases complicated by other pelvic conditions and to those that do not yield to the radium treatment. Kelly treats fibroids by dilating the cervix and introducing radium directly into the uterine cavity, varying in amount from 30 to 724 mg. The radium must be placed in the uterine cavity as opposed to the cervical canal and, in very large tumors, this can be supplemented by massive treatment through the abdominal wall. He reports the results of thirty-six fibroids treated by radium, the patients' tumors in some varying in age from thirty to sixty-seven years and the cases extending to the umbilicus. The chief symptom demanding relief in most cases was hemorrhage, though in some cases there was dysmenorrhea and lower abdominal pain. The results of the radium treatment in every case but one have been either shrinkage of the tumor or its complete disappearance, the time of occurrence varying from two months to one and a half years after the treatment was begun and, in some cases, the shrinkage continues long after treatment is suspended. All types of fibroids, such as the subperitoneal, submucous, etc., respond equally well to the treatment and the radium can bring about amenorrhea in all cases. Kelly believes that a large dose of radium applied over a short period of time is preferable to a small dose applied over a long time, as abdominal discomfort and persistent leucorrhea are apt to follow this latter method of treatment. In cases in which radium fails in its application, it does not make subsequent operation more difficult than if it had not been used. The treatment is ideally adapted to anemic and weak patients, and, if the patients are too weak for intra-uterine application, the radium can be applied through the abdomen. He is very enthusiastic over his results and feels that with increased experience it will be possible to relieve every patient of hemorrhages and to cause the tumor to disappear in 90 per cent. of the cases without serious discomfort or risk. Enthusiastic reports also come from Abbe,<sup>1</sup> whose experience with radium is too well known to need further comment. He states that radium causes an obliterative endarteritis and while he agrees with Kelly that the radium treatment is ideal in cases of fibroids of the uterus, especially in anemic patients, he does not recommend the treatment in cases of pedunculated fibroids. It is the method of choice, however, in all other cases, as its first effect is cessation of the bleeding, while the shrinkage of the tumor continues slowly and

<sup>1</sup> Medical Record, 1915, lxxxvii, 379.

gradually. He has obtained speedy and wonderful results by using from 50 to 100 mg. of radium element in concentrated form in tubes placed in thin, smooth applicators without filters, using a single application of two hours' duration. If, after two months, hemorrhage recurs, the treatment may be repeated.

**Röntgen Therapy.** Although radium has largely superseded the Röntgen ray in the non-operative treatment of malignant disease, the  $\alpha$ -ray still retains much of its popularity of the last few years in the treatment of many of the benign affections of the uterus. In the Röntgen Institute of the Frauenklinik at Berne, the  $\alpha$ -ray has been applied in cases of myoma, climacteric hemorrhagic metropathies, marked dysmenorrhea in young women, pruritus ani and vulvæ, inoperable malignant

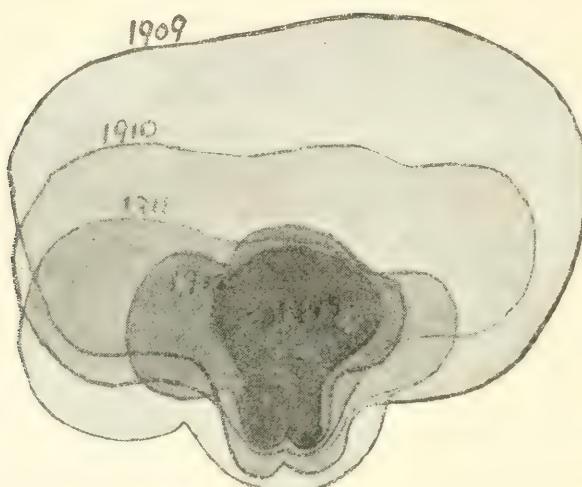


FIG. 96.—Progressive Reduction of fibroid tumors after exposure for four hours to 60 mg. radium in the uterus. (Abbe.)

neoplasms and as a prophylactic after radical operations for malignant neoplasms. According to Steiger,<sup>1</sup> the  $\alpha$ -ray was applied to 23 cases of myoma, the tumors varying in size from a fist to a man's head, while the age of the patients varied from thirty-five to fifty-six years. Of the 23 patients, 3 did not conclude the treatment; of the remaining 20, 17, or 85 per cent. were cured, 1 considerably improved, 1 is still under treatment and a cure is expected, and the remaining one is unimproved. The dose of raying varies from 500 to 2400 X and the duration of the treatment of those cured varies from six to fifteen weeks. The signs of improvement, which are cessation of bleeding and reduction in the size of the tumor, begin to manifest themselves after three to four weeks following one or two massive doses. In all cases, except those

<sup>1</sup> Cor.-Bl. f. schweiz. Aerzte, 1915, xlv, 257, 298, 331.

who are extraordinarily anemic on admission, a preliminary curettage is performed in order to rule out malignancy.

*Technic.* Steiger uses cross-fire deep therapy and divides the abdomen into twelve fields, and also uses two fields on each side of the back, making sixteen fields in all, each field being from 25 to 36 cm. in diameter. An aluminum filter, 3 mm. thick, is used and the tube is placed 18.5 cm. from the skin. From 12 to 15 ampères are used with an exposure of from eight to ten minutes, which equals from 25 to 30 Kienböck units. The advantages of radiation over operation are that there is no operative risk or primary mortality, nor is there any risk of anesthesia, since many patients who are subjected to operation, take anesthesia poorly or not at all. Further, we need not fear the dangers of postoperative complications, such as pulmonary emboli, septic peritonitis, phlebitis, thrombosis, ileus, and wounds to the ureters.

In the operative treatment of fibroids, the mortality among various noted operators is as follows:

Name of operator.	Number of cases.	Mortality. Per cent.
Franz . . . . .	121	0.82
Walthard . . . . .	133	1.4
Krönig . . . . .	170	3.5
Sarwey . . . . .	149	4.1
Zweifel . . . . .	157	8.2

These figures represent the extremely low primary mortality among the best operators taken the year before the introduction of the *x-ray* treatment. As opposed to these figures, *Röntgen therapy has no primary mortality*. Although the *x-ray* affects the ovaries, especially the follicular apparatus, the great reduction in the size of the myomata, sometimes after a single exposure, is not due to the effect on the ovary but to the effect of the rays on the myomatous tissue itself. The same effect has been observed after castration except that a much longer time is required than with this method. Myoma patients frequently complain of obstinate constipation, but this often disappears after one treatment. Another advantage of *x-ray* treatment is that the patient is ambulant and does not need to stay in the hospital, thus saving considerable time and expense since in operative cases the patient is obliged to remain in the hospital at least three weeks and even then cannot resume her usual work.

Steiger says that there are no *contraindications* to the *x-ray* treatment, but as a rule there is a restriction according to the type of tumor, thus gangrenous myomata or one incarcerating the bladder should be removed surgically, as the ray treatment will not accomplish its result rapidly enough. In young women, also, operation is the method of choice, for while myomatosis makes the woman sterile, the sterility can often be relieved by operation, that is, by means of myomectomy. The frequency of sarcomatous change in a myoma is about 2 per cent.,

according to the Freiburg clinic, based on microscopical sections, but statistics vary greatly on this point. The average mortality from abdominal section for myoma is 4 per cent., and operation in cases of sarcoma give only 25 per cent. of cures in the best hands, so that a very small number of sarcomata of the uterus are cured by operation. Moreover, the diagnosis of sarcoma is not easy in any case in the early or operable stage, therefore it is just as safe and justifiable to treat the doubtful cases with the Röntgen ray and if, after a few months, the symptoms do not subside, the patient is not in any worse condition for an operation than before the radiation.

Among other gynecologic conditions which Steiger has treated by the *x*-ray, there were 4 cases of climacteric hemorrhagic metropathy varying in age from forty-three to forty-nine years. They required from three to five treatments over a period of from six to twelve weeks, and the dosage varied from 577 to 1631 X. A preliminary curettage was performed in all the cases and showed that there was no carcinoma present. Of the 4 cases, 3 were cured and 1 was improved, this latter patient withdrew before completing the treatment. There were 2 cases of dysmenorrhea in young women that were treated, and, in both, the pain diminished and the hemorrhage subsided to the normal amount of menstrual flow. The dosage used was 271 X in one, and 112 X in the other. Sterility does not ensue in these cases unless the treatment affects the follicular apparatus to a marked degree, since there are so many follicles that many escape the effect of a single radiation. Besides reporting 3 cases of pruritus ani and vulvae which were successfully treated by radiation, Steiger calls attention to the importance of radiation after the Wertheim operation since most German authors state that they have been getting much better results since making this a routine practise.

Some noteworthy refinements in technic are emphasized by Heynemann,<sup>1</sup> who is in accord with other röntgenologists in that deep therapy, cross-firing and filtration are the most important points in the new technic. His experience shows that between 30 and 40 X of filtered ray causes a skin burn, so that he cautions against using more than 30 X as a dose. He formerly placed the aluminum filter in a leather or cloth cover on the skin of the patient, but some burns followed this method so that it was discontinued and, instead, the filter is now placed near the tube. A plate is also placed on the skin for the purposes of compression; the focal distance between the skin and the tube should be about 25 cm. The Freiburg school gives a large dose over a short period of time in order to obtain a quick result, while the Hamburg school gives just sufficient dosage at each treatment to barely obtain a noticeable effect, in order to avoid injury. Heynemann, like most

<sup>1</sup> Therap. Monatsh., 1915, xxix, 78.

other workers, takes the mid-view between these two extremes, and uses from three to five skin fields in addition to one perineal field, giving from 10 to 20 X to a field every four weeks until the effect is noticed and if there is no effect after a reasonable time, the case is considered operable.

Pfahler<sup>1</sup> has had considerable experience in this country with the Röntgen treatment of *fibroids* and states that the indications for the treatment of hemorrhages due to myoma are fairly well defined, and may be classified as follows:

1. All cases of myoma in older women in whom there is already an advanced anemia which may be the cause of an anemic heart.

2. All elderly and young women with myomas in whom there is marked organic heart disease, diabetes mellitus, chronic nephritis, marked lung disease and goitre with cardiac symptoms.

3. All patients beyond the age of forty in whom there is no contraindication to the treatment. In general, the older the patient and the nearer she has approached the menopause, the more prompt and satisfactory will be the result. Under forty, Röntgen therapy is not the method of choice, but good results can be obtained, though the younger the patient, the greater the amount of treatment that will be required. Even in patients under forty, if the alternative is complete extirpation of the uterus and adnexæ, Röntgen therapy should be seriously considered, for it is claimed that even with the disappearance of the Graafian follicles and the destructive effect on the reproductive functions, there is a preservation of the internal secretion of the ovary. The treatment is contraindicated in fibroids that have undergone malignant degeneration or have become gangrenous; in all cases of pedunculated myomata where the tumor can be excised without destroying the reproductive powers of the patient; in fibroids associated with disease of the adnexæ and in cases where the fibroid is causing such marked symptoms that the patient is endangered more by waiting two or three months for the results of Röntgen therapy than by the operation itself.

RÖNTGENIZATION *versus* OPERATION. It is interesting to note that most of the enthusiastic reports concerning the value of the *x-ray* and its advantage over operation in the treatment of uterine fibroids have come from the röntgenologists themselves, and while most surgeons feel that there is much of value in this treatment, they have not accepted it with a correspondingly high regard. At a meeting of the New York Obstetrical Society on May 11, 1915, the subject of Röntgen treatment was thoroughly discussed by many men who have had experience with both methods of treatment and most of the members seemed to feel that the chief danger in the ray treatment lies in the fact the the absolute diagnosis of uncomplicated fibroids is frequently very

<sup>1</sup> American Journal of Obstetrics, 1915, lxxii, 79.

difficult, and the chance of overlooking malignancy and associated pelvic inflammatory disease is very great. Further, the mortality following operation is due to the difficulty in operating on the complicated cases, while in the simple uncomplicated cases, the mortality compares very favorably with that following the ray treatment and is under 1 per cent.

A case in point, illustrating the difficulty of diagnosis in certain cases of fibroids, is reported by Vineberg,<sup>1</sup> who believes that it is an argument against the *x*-ray treatment of all supposed fibroid tumors. The patient was a widow, twenty-eight years of age, who had three children and had always been in good health and whose menstrual history was normal until four months before admission to the hospital, when the periods became prolonged, lasting ten or eleven days. The uterus was found to be retroverted, globular and enlarged to the size of a two months' pregnancy. A diagnosis of submucous fibroid was made, and, owing to the youth of the patient, it was decided to incise the uterus and enucleate the tumor, if possible, and thus conserve the uterus and ovaries. After exposing the growth, a portion of it broke down and exposed some grayish, friable material which was very suspicious of malignancy and which the microscope showed to be adenocarcinoma. The unusual features of this case are the youth of the patient, the absence of intermenstrual bleeding, the rapid growth of the tumor and the impossibility of making a correct diagnosis from the symptoms and local findings. Not only must we bear in mind the question of complicating malignancy at the time of treatment, but we must also remember the possibility of malignancy developing in the uterus at some later date. Certain writers state that no cases of malignancy have been observed, which developed in a uterus after it had been treated by the *x*-ray.

In order to correct any such false impressions, Shoemaker<sup>2</sup> reported the case of a patient who began to take Röntgen therapy for a uterine fibroid in November, 1907, and received fifty-four treatments of ten minutes each, at 20 inches distance with a spark gap of 4 inches. By April 1, 1908, the hemorrhage was controlled, and the tumor was one-fourth its original size. Nine months later the tumor grew again, and the patient was subject to eleven more treatments which again decreased the size of the growth. In December, 1913, hemorrhage reappeared, and operation was advised and performed in April, 1914. The operation consisted of an abdominal hysterectomy and the pathologist reported that the tissue removed was a fibroid tumor undergoing sarcomatous degeneration.

According to Frank,<sup>3</sup> the ray treatment is applicable to only from 5

<sup>1</sup> American Journal of Obstetrics, 1915, lxxi, 811.

<sup>2</sup> Journal of American Medical Association, 1915, lxiv, 1653.

<sup>3</sup> American Journal of Obstetrics, 1915, lxxii, 408.

to 6 per cent. of all patients having fibroids, representing the cases in which operation is declined or contraindicated by serious organic disease or extreme physical unrest. The rays should not be used when time and expense are factors and cannot be used with safety in rapidly-growing tumors, fibroids complicating pregnancy or serious adnexal trouble, and in cases in which complete preliminary curettage with microscopical examination of the curettings is not feasible. *Some statistical investigation* on the subject was made by Tracy,<sup>1</sup> who found that in a series of 3561 cases of uterine fibroids that were operated upon, associated malignancy, degenerative changes in the uterus and tumor, and lesions of the appendages, in which there was not the most remote hope of a cure from Röntgen therapy, were found in 1189, or 33.38 per cent. Of the degenerations and changes in the tumor and uterus, there were 501, or 14 per cent. of the cases in which the lives of the patients would undoubtedly, sooner or later, have been sacrificed had they been treated only by Röntgen therapy. A certain number of the tumors in which cystic (3.5 per cent.) and hyaline (1.8 per cent.) degenerations were present would have broken down under Röntgen treatment, which would, conservatively stated, have increased the number to 15 or 16 per cent. If we add to these 501 cases, 405 cases of ovarian cyst, cyst and abscess of the broad ligament, tubo-ovarian abscess, ectopic gestation, not mentioning pyosalpinx, we have a total of 906, or 25.4 per cent., of the cases in which the lives of the patients would have been lost if they had been relegated to the röntgenologist. It is well recognized that the most serious complication of fibromyomata uteri is malignancy, which varies, according to different authors, between 4 and 12 per cent., while sarcoma will be found in about 4 per cent. of the cases. In view of the statements made by the röntgenologists that the *x*-rays should be used in the treatment of fibromyomata uteri only in women past the age of forty years, Tracy investigated the age at which the various changes and degenerations take place in these tumors and found that, in another series of 693 cases, the age at which these changes took place varied from twenty-three to seventy-two years and in the 196 cases in which the degenerations occurred, 136, or 69 per cent., occurred after the age of forty years. Of these degenerations there were 26 cases of malignancy, 24, or 90.3 per cent., of which took place in women past the age of forty years. Therefore he would limit the *x*-ray treatment of fibroids to women whose general health is so much below par from any cause, that they could not withstand the shock of an operation or cases of marked anemia, to temporarily control the bleeding until the patient is sufficiently restored to health to undergo an operation. The rays may also be used in patients who continue to bleed after a myomectomy, in whom a microscopical examination of

<sup>1</sup> Pennsylvania Medical Journal, 1915, xviii, 353.

the tumor and endometrium shows no evidence of malignancy. When we consider that over 33 per cent. of patients with fibromyomata uteri could not be cured by Röntgen therapy, that over 25 per cent. would sooner or later perish under such treatment, that the tumor can be removed by skilled surgeons with a mortality of less than 3 per cent., Tracy believes that the only rational treatment for these tumors, which produce symptoms, with the few exceptions given, is early surgical intervention.

*A Similar Opinion from Sweden* is given by Olow<sup>1</sup> of the gynecologic clinic of the University of Lund. He found 8 cases of malignant disease among the 205 operative cases of uterine myoma up to the year 1909. Since then, 8 new cases have been encountered among 154; 5.2 per cent. were thus complicated with cancer. This percentage is larger than that reported from the average clinic, probably because the microscope is used more regularly at Lund than elsewhere, even when macroscopic indications of cancer are not apparent. A very significant fact is that the presence of cancer had not been diagnosed in any case before operation, and had been suspected in only one. In another case, one ovary had been left after the removal of nearly the whole of the uterus in a woman of fifty, and necropsy nearly a year afterward showed a cancer that had developed from the stump of the ovary. Based on his experience, Olow believes that a total hysterectomy is advisable in myoma cases, whenever conditions favor it, regardless of whether there is known cancer or not.

**Desiccation Surgery in Gynecology.** Desiccation was devised eight years ago by Wm. Clark,<sup>2</sup> and has been practised by him ever since. The rationale of this method of treatment is based on the following points: The effect of heat when applied to living tissues varies, according to its intensity, from simple hyperemia to carbonization. Somewhere between these antithetic points there is a thermic degree, the effect of which is more than hyperemia but not the extreme effect of carbonization. This point Clark calls the *desiccation point*, because this term seems to describe the effect on the tissues better than any other. When a thermic intensity at the desiccation point is generated, controlled and sustained upon or into a given area of tissue, dehydration of the tissue ensues, the cell capsule is ruptured and what was before living tissue, is then transformed into a dry, sterile inert mass. The advantages of desiccation surgery are that abnormal tissue may be devitalized rapidly by means of a bloodless procedure. It is a precise method, the smallest discernible point may be treated, as may a growth covering a large area, and to a depth within the limit of safety. No anesthesia is required, as a rule, since the current has anesthetizing

<sup>1</sup> Arch. Mens. d'Obst. et de Gyn., 1915, iv, 369, by Journal of American Medical Association.

<sup>2</sup> American Journal of Obstetrics, 1915, lxxii, 63.

properties if properly applied. A peculiar feature of desiccation is that it has a devitalizing action on cells of less vitality than normal cells, somewhat deeper than the desiccated area, the normal cells recovering. This has been shown by the disappearance of malignant tissue at points removed from the area actually desiccated. The current sterilizes the tissue, hence healing progresses rapidly and the lymph channels are sealed, thus lessening the likelihood of metastases in cases of malignancy. Unlike the results after the use of the cautery, there is absence of contracted cicatricial tissue. There are no disadvantages of the method other than the expense and cumbersomeness of the necessary apparatus. The difference between the fine desiccation effect and the coarse high-frequency or fulguration effect lies in the fact that a perfectly steady static current is used and not an interrupted current generated from a Rumkorf coil. Clark is very particular in emphasizing the difference between desiccation and fulguration, although by many they are considered to be the same process, and he states that the destructive effect on the tissue produced by the coil type of current may be compared to a surgical operation with a saw-edged knife, while the devitalizing effect produced by the static type of current may be likened to the more refined action of a keen-edged bistoury.

*Indications.* In growths, such as venereal warts, leukokeratoses, simple and pigmented moles, polypi and angioma, desiccation is almost uniformly successful, one application being sufficient, the lesion being transformed into a dry crust. This may be immediately curetted or cut away with scissors, or it may be allowed to slough away according to the judgment of the operator. After curetting or cutting, if there is bleeding, it is due to imperfect technic, although it requires more careful technic to prevent oozing of mucous membranes than of the skin. Chancroids, chancres, lupus vulgaris and erythematosis, pruritus ani and vulvæ, fissures of the vagina and rectum, vesical, vaginal and cervical growths are all satisfactorily treated by this method. Early cancer of the cervix should never be treated by desiccation because the chances of cure by radical operation should not be denied the patient. If the cancer is inoperable, desiccation as a palliative measure, has advantages over the curet and cautery for the reasons that a general anesthetic is unnecessary, there is less marked inflammatory reaction, it destroys the diseased tissue quite as effectively, sterilizes, deodorizes and stops bleeding. The cervix, when cancerous, is peculiarly insensitive to desiccation and can be treated as radically as desired without even a local anesthetic.

**Personal Views on Non-operative Methods of Treatment.** Within recent years, we have witnessed in the newer issues in the cancer problem the complete departure of gynecologists from vaginal hysterectomy to the abdominal method of removal of carcinomatous uteri. Up to three years ago, German literature was replete with reports of results from

these more radical procedures. Instead of limiting the panhysterectomy to those cases in which the cervix alone was involved, it was extended to even the most advanced cases in which the glands were involved. From this radical standpoint, a recession soon set in; the small percentage of ultimate recurrences did not offset the high primary mortality and the wretched postoperative sequelæ. Within the last few years, a wave of enthusiasm for radium in the treatment of cancer swept over France and Germany and, to a lesser degree, conservative England, and from the literature the inevitable conclusion is drawn that radium offers excellent possibilities in the treatment of superficial growths and for the relief of hemorrhage and malodorous discharge in extensive cases, but that no extreme degree of optimism can be gathered from these reports since they all point to the fact that the deeper metastases are not reached by the radium, upon which hangs the fate of the patient. The best statistics of radical treatment, in selected cases are not over 50 per cent. of cures after the five-year period, so that we must search for better methods than the radical operation. Krönig believes that radium is preferable to the radical operation and, indeed, our own experiences with radium have been very satisfactory and in some cases even startling, but as Burnam points out, in about one-third of the cases, radium seems to actually stimulate the growth instead of retarding it.

Five years ago, I reached the conclusion that when the deeper iliac glands are the seat of metastases, attempt to cure these patients is futile. Thus far we must conclude that there is not sufficient evidence to justify the substitution of radium for surgical measures in cases which are operable. I never use less than 50 mm. of radium, as smaller doses seem to stimulate the growth. The immediate action of radium is very markedly good in its effect on the ulcer, hemorrhage, discharge and general condition, but none of our cases have gone past even the three-year period, and, as Krönig has said, we must not count a case as cured until five years have elapsed without recurrence. As a fore-runner to and a follower up of operation, it is unquestionably advisable. In inoperable cases, it should invariably be tried, for apparent cures have occurred in some very advanced cases, and in the cases not ultimately cured, there is a decided amelioration of symptoms. The occasional production of necrosis need not deter one from the use of radium, as this occurs in the advanced cases.

In addition to cancer, radium has been found of use in myoma, metritis, especially at the menopause, and, of late, in intractable dysmenorrhea. This latter fact, I first found out in applying radium in a case of myoma associated with dysmenorrhea, and, following the application, the dysmenorrhea was relieved. This is probably due to the effect of the radium on the ovary. I have only dared to try it in one case of this type and that was in a girl twenty-six years of age,

who had had all of the various methods of treatment for this condition without relief, and was taking a grain of morphine at a time when her periods came on. I applied a medium-sized dose of radium for twelve hours, but thus far this treatment has not been followed by relief. In fibroid and chronic hemorrhagic uteri at the time of the menopause, radium causes rapid cessation of the hemorrhage in almost every case. While practically all carcinomata belong to surgery, fibroids in patients above forty years of age should be subjected to the radium treatment as it is without any danger, which is more than can be said of even the best operative procedures in the best hands. If the patient is under forty, the tumor should be removed by operative means, as in this way the functional value of the ovary is maintained and frequently enough of the uterus can be left so that she will have a slight menstrual flow, which to her is the badge of womanhood, while on the other hand, radium is very apt to cause ovarian atrophy with cessation of menstruation. If the application of radium seems to have effected a cure in a previously inoperable case of carcinoma of the uterus, I do not believe in operating, because the surgeon cannot possibly reach cells that the radium has missed and an operation might only be the means of renewing the activity of an apparently quiescent condition. Radium is not of much use in cancer of the rectum, indeed our experience has been very discouraging with its use in this condition.

Perhaps the best report upon the treatment of cancer by means of the *x-ray* comes from Professor Bumm, of Berlin, who is inclined to predict that this agent will supersede radium. He has endeavored to perfect a method of treatment which will eliminate serious burns of the normal tissue, and, with the use of the newer tubes, he suggests the possibility of application without vaginal treatment. From his experiments, he believes that many cases of hitherto unfavorable deep-seated cancers may be offered hope of cure. With regard to the röntgenologic therapy of fibroid tumors by radiating the ovaries, we must realize that the ovaries have a very potential influence on the well-being and general make-up of the body, and we should be very careful to preserve that influence. Therefore my feeling always has been, just as in the case of radium, that in young women who are the subjects of fibroid tumor of the uterus, surgical operation should be the method of choice. I have tried the *x-ray* in some cases in older women and have had very good results, but this treatment must always be preceded by a preliminary curettage of the uterus in order to rule out malignancy, and this latter point cannot be emphasized too often.

In *chemotherapy*, thus far no measures have proved of real value in the treatment of cancer. The treatment of the disease by *cancer extracts* and by the various *sera* has proved to be worse than valueless. With regard to the treatment of cancer by *heat* as outlined by Percy, I believe that the majority of surgeons in the United States attempting

to use this method assume that Percy uses a cauterizing heat, not realizing that the "cold cautery" is the essential point in the technic. I strongly recommend the method and believe that it holds out definite promise of favorable results if Percy's rules are accurately followed. I feel, however, that radium offers equally good chances for cure without the greater danger of mortality incident to this operation, but if a man has not the opportunity of obtaining radium, he should follow this technic and I believe that he will get good results. I do not believe in operating after the heat has been applied, as this means the breaking down of scar tissue and a possible stimulation of the process to renewed activity.

My experience with desiccation has been limited to cases of papilloma of the bladder, in which I have obtained very good results in properly selected cases.

**An Analytical Study of Fibroids** was made by Yamasaki<sup>1</sup> on a series of 163 cases. He found that the age at which these tumors most frequently gave symptoms was between forty and fifty years. With regard to the location of the tumors in this series, 71 were interstitial, 36 subserous, 30 submucous and in 26 cases there was a combination of two or three varieties. Of the clinical symptoms, hemorrhage, either as menorrhagia or metrorrhagia, was noted in 51.5 per cent. of the cases; pain in 52 per cent., in 18 cases in the form of dysmenorrhea; bladder disturbances, chiefly as urinary frequency, in 27.6 per cent.; ascites in 12.9 per cent., usually found in pedunculated subserous tumors. Adhesions were most commonly found in cases in which the tumors were of the subserous variety and usually involved the omentum. Yamasaki does not believe that the frequent appearance of cardiac disease in subjects who have fibroid tumors is purely accidental, but he states that there seems to be some close relation between the two diseases, since he found 35 cases with heart changes in this series. Of the 163 cases studied, all were married, 79 having had children, while 84, or 51.5 per cent., were nulliparous. Of the 79 cases that had borne children, 25 had dystocia. There were 3 cases that showed carcinomatous, and 3 that showed sarcomatous, changes in the tumor.

**Iodine in Supravaginal Hysterectomy.** As a method of preventing infection about the stump in supravaginal hysterectomy, Stone<sup>2</sup> lauds the use of an alcoholic solution of iodine, and recommends the following technic in its use. The patient is placed in the lithotomy position, and a 25 per cent. alcoholic dilution of the official tincture of iodine is applied over the genitals and introitus vaginae. The cervix is then grasped with a tenaculum and dilated, and an ounce of the iodine solution is slowly injected into the uterine cavity with a glass syringe. The cervical canal is then again gently dilated to allow the discharge of the

<sup>1</sup> Sei-I-Kwai Medical Journal, 1915, xxxiv, 45.

<sup>2</sup> American Journal of Obstetrics, 1915, lxxii, 74.

excess of the iodine solution. Every part of the vagina is then exposed and treated with the iodine solution. The operation is then commenced and before closing the cervical stump, an application of iodine is made to the flaps if there is the slightest suspicion that infectious matter has been handled. Stone particularly warns against the use of too great a quantity of iodine or of applying too much force in injecting it, as iodine is a toxic agent and is quickly absorbed from the mucous membrane, while if too much force is used, the patient may show symptoms of shock. In our clinic, we occasionally inject iodine into the uterine cavity, using a 5 per cent. solution of iodine crystals in alcohol, which is somewhat stronger than the author recommends, but which has never caused any trouble so far as we have seen.

**Pituitary Extract in Uterine Bleeding** has been recommended by Jacoby,<sup>1</sup> who has used it in 15 cases of menorrhagia and metrorrhagia in cases of anemia, threatened abortion, hypertrophied endometrium, fibrosis uteri, fibroids, subinvolution, retroversions and disease of the adnexa. In every case of menorrhagia, the duration and amount of the menstrual flow have been diminished, while in metrorrhagia the duration and amount of the flow have been diminished and the intervals between the periods have been lengthened to more nearly normal. Jacoby uses one grain of pituitary extract, representing three grains of the fresh gland, given hypodermically, repeated every other day for ten doses, although it is not always necessary to give quite so many. Aside from lower abdominal cramps and nausea, no untoward symptoms follow the injections.

**Retroversion of the Uterus.** Each year brings forth, among other things, one or more new operations for the correction of posterior displacements of the uterus, and at present there are so many "best methods" that the surgeon will become greatly bewildered if he attempts to cover the literature on the subject. In December, 1914, the Philadelphia County Medical Society held a symposium on the operative treatment of retroversion in which several of the leading gynecologists of the country participated, each man giving the details and results of his own operation.

*Hirst*<sup>2</sup> reported a new method which he had devised and which is a modification of the Alexander operation, performed through the Pfannenstiel incision, which permits of an inspection of the viscera and is combined with a temporary suspension of the uterus. He had been employing the Alexander operation for a period of over twenty years and was well satisfied with his results except that the operation did not permit of an inspection of the viscera, and, consequently, in some cases, diseases of the appendix, tubes and ovaries went unrecognized. To obviate this objection, he has modified the operation by making a

<sup>1</sup> Medical Record, 1915, lxxxvii, 226.

<sup>2</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 599.

low Pfannenstiel incision and through this the round ligaments are exposed on each side by cutting open the inguinal canals. After expos-

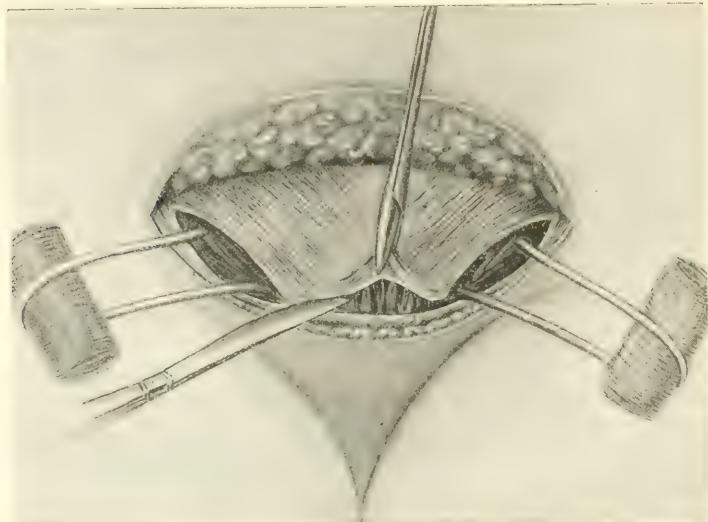


FIG. 97.—(Hirst.)

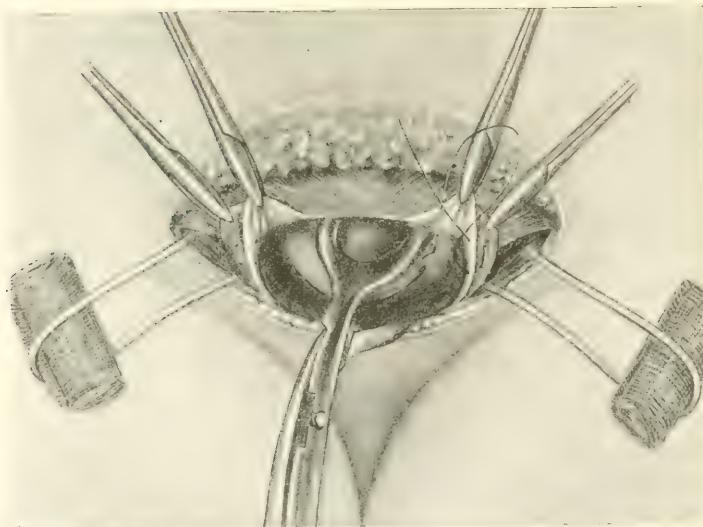


FIG. 98.—(Hirst.)

ing about six inches of each round ligament, the inguinal canals are united by incising the intervening fascia, and then the peritoneal cavity is opened. The pelvic organs can then be inspected and attended to,

if necessary. The uterus is suspended by a simple ventrosuspension and the wound closed. Before the fascia is closed, the round ligaments are sutured to the external oblique muscle and Poupart's ligament on each side, and to each other in the mid-line. The ventrosuspension part of the operation consists of a single suspension stitch of catgut and is applied to support the uterus temporarily while the shortened round ligaments are becoming fixed in their original canals.

Gilliam<sup>1</sup> described his operation, which is the pioneer ventrosuspension of the uterus by means of the round ligaments, in which the ligaments are left intact in their natural investments. The technic of this operation is well known, suffice it to say that it consists of catching the round ligaments at a point about one and one-half inches from the



FIG. 99.—(Hirst.)

uterus on each side and drawing them through stab wounds made through the fascia, muscle and peritoneum about one inch from the wound edge on each side and anchoring them to the fascia. In answer to the various objections raised against this operation, Gilliam states that the practical results outweigh theoretical deductions, and it has stood the test of time for fifteen years, and he does not know of one case in which pregnancy or parturition has been embarrassed by it nor has there been a single case of strangulation of the bowel. Most of the failures of this operation are due to insecure attachment of the round ligament to the abdominal wall, due to the fact that the ligament, where it passes through the puncture wound, is very much constricted,

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 608.

whereas the exposed part is turgid and swollen, so that, taking the swollen part as a guide, when the anchoring suture is introduced to catch the constricted part, it will occasionally go to one side or the other of the ligament, and the loop, not being anchored, will pull out of the stab wound in a short time and the operation fail. To obviate this, the ligament should always be tested as to the firmness of its fixation before closing the abdomen.

Cragin,<sup>1</sup> having been impressed by the great number of recurrences of retroversion after the Alexander operation and of the frequency of dystocia following simple ventrosuspension, has been employing the Gilliam type of operation with certain modifications. In the first place, he performs the operation through a Pfannenstiel incision as this makes the technic simpler. On account of the danger of sloughing of the loop of round ligament which is pulled through the constricting fascia, which occurred to him in one of his early cases, he anchors the round ligament just beneath the fascia and does not draw it through the stab wound. He was able to trace 164 of his 400 cases, and, among them, he found 2 partial anatomical failures, 2 complete anatomical failures and 2 symptomatic failures although anatomical successes. The operation does not increase the discomfort of pregnancy, does not cause an increase in the frequency of miscarriage nor does it cause dystocia or puerperal complications.

Montgomery<sup>2</sup> stated that his operation consists in making an opening in the anterior fold of the broad ligament, carrying a loop of round ligament outward between the layers of the broad ligament until the reflection of the peritoneum is reached, then bringing the loop through the abdominal wall and fastening it to the external surface of the aponeurosis as in the Gilliam operation. It is not applicable to all cases any more than is any other operation a sure cure in all types of retroversion, but in certain cases it must be supplemented by other types of operation, such as shortening of the uterosacral ligaments or folding the retro-uterine peritoneum. In cases uncomplicated by prolapse, Montgomery considers it an efficient measure for correcting a retro-displacement.

Bovè<sup>3</sup> stated that retroversion is nothing more than a symptom, and he believes that uncomplicated retroversion has no symptoms. The uterus is maintained in its normal position by the intra-abdominal pressure, the uterine supports and the vaginal walls combined. Intra-abdominal pressure, as such, plays a very insignificant part in maintaining the uterus in its normal position. The vaginal walls are an important adjunct to the action of the uterine supports and proper surgical treatment of retroversion of the uterus should always include the proper treatment of rectocele and perineal lacerations. The uterine ligaments

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 602.

<sup>2</sup> Ibid., 612.

<sup>3</sup> Ibid., 606.

are the most important factors in maintaining the position of the uterus. The round ligaments are for the purpose of pulling the upper pole forward as the contents of the bladder are expelled, but are not very efficient as anterior supports. There is a constant antagonism between the action of the uterovesical and uterosacral ligaments on the lower pole of the uterus, the former tending to pull the cervix forward, the latter to pull it backward. As the cervix goes forward, the fundus becomes retroverted; therefore, although the round ligament operations are as successful as any other single operation, they should be supplemented by the necessary work on the ligaments of the lower pole, namely, the uterovesical and uterosacral. In each case, the exact cause of the displacement must be sought and the proper operative work performed without any predilection for any one particular operation.

Webster<sup>1</sup> also emphasized that in the first place, a damaged pelvic floor must always be repaired. The abdomen should next be opened and the course of procedure will depend on the conditions which exist. In a typical, well-marked case of retrodisplacement, without important complications, where the uterosacral ligaments are much stretched or obliterated, Webster first performs what is called "shortening of the uterosacral ligaments," but what really is making new ligaments out of the parietal peritoneum and subjacent tissue. These tend to hold the cervix in its normal position, the long axis being directed downward and backward. Linen sutures are used in order to obtain a better development of fibrous tissue than will follow the use of catgut. Following this, the uterus is placed in an anterior position and held there by the Webster type of operation which consists of suturing the round ligament to the posterior surface of the uterus, after bringing them through the broad ligaments, just beneath the utero-ovarian ligaments. It is very important to close the openings in the broad ligaments so that no raw surface is left behind and that there will be no chance for the development of an internal hernia. The after-care of these patients is important. All forms of strain liable to affect the stitched parts, and standing for long periods of time must be avoided for several months. When pelvic repair work has not been carried out, a Smith pessary is often inserted into the vagina before the patient had left the hospital, advising her to wear it for several months, especially when she has a chronic cough or is liable to work too soon. Pregnancy should not be allowed to commence until a year has elapsed, and then it is advisable that a pessary be worn during the first three months. Further, after the eighth day of the puerperium, it is advisable to use a Hodge or Smith pessary for several months.

Baldy,<sup>2</sup> whose name is often coupled with that of Webster as a joint originator of the posterior fixation operation, believes that nine-tenths

<sup>1</sup> *Surgery, Gynecology and Obstetrics*, 1915, xx, 610.

<sup>2</sup> *Ibid.*, 614.

of the operations performed on women for retrodisplacements are uncalled for, since the symptoms for which the operation is done are usually due to complications and not to the displacements themselves. The one point in which he considers the Baldy-Webster operation superior to all others, is the fact that when the operation is performed, not only is the uterus itself put into proper position, but the ovaries are also replaced and held up at a proper level without any extra manipulation, and there is no other operation that does this at all.

The symposium was a very interesting affair in that it was curious to note how each man is able to obtain excellent results with his own method of operating, largely to the exclusion of other methods, and yet we are not able to determine on a *single* operation as the one best. Personally, I have found the Coffey operation to give the best results in my hands and have adopted it as our standard. It possesses the advantage of getting rid of the redundant round ligament and at the same time of utilizing the relaxed anterior leaf of the broad ligament of restoring the uterus to its proper position. We have done at least 300 of these operations with the greatest satisfaction, but it has certain limitations. Whenever there is considerable elongation of the utero-sacral ligaments, it does not suffice, for although it holds the uterus in anteflexion, it does not prevent it from sagging into the vagina and causing some irritability of the bladder. We have tried the Baldy-Webster operation and have discarded it on the ground that the convalescence is not satisfactory in that the patients usually complain of pain, sometimes quite severely, in both ovarian regions. It is possible that our technic may not have been in strict accord with that which the inventors have described, but it appears to me that, anatomically, it possesses serious objections. In perforating the broad ligaments and dragging the round ligaments through and attaching them to the posterior wall of the uterus, cicatricial bands may form which limit the circulation at the site of the utero-ovarian anastomosis, and a local congestion may be caused. Our head nurse in the gynecological ward at the University Hospital, who has followed these cases very carefully during their convalescence, is outspoken in her preference for the Coffey type of operation. According to her observations, one set of patients get up and go about moderately comfortably from the start, whereas the others complain of pain in the ovarian regions for several days or even longer after being on their feet. This operation is too suggestive of suspending the human body with crutches. They keep the body upright but then the patient suffers in the armpits. I have never been favorably disposed toward any type of operation which looks to the inguinal canal as the point of correction. I am in accord with the majority of observers, that a simple uncomplicated retroverted uterus does not give symptoms, and therefore the complaint of the patient, which may be referred to malposition, is in many cases due to patho-

logical conditions in adjacent organs and therefore a liberal incision is indicated and not a stab wound, such as we formerly took pride in making, which will permit a thorough investigation of conditions adjacent to the uterus and even a manual excursion into the upper abdomen to ascertain the condition of the kidneys, gall-bladder and stomach. As to the Gilliam operation and its modifications, I have performed them a few times but have always been fearful of intestinal obstruction, but, judging from the excellent reports of the men who employ this method constantly, the danger must be very slight and my apprehensions may have been groundless.

ANOTHER REVIEW OF THE SUBJECT has been made by Meeker<sup>1</sup> who speaks of eighty methods that have been devised to correct the condition of retroversion, showing "the ingenuity displayed in playing with a sort of anatomical puzzle, the object of which is to determine the greatest number of means by which the same end may be attained and allow the patient a continued existence." After reviewing the various operations which have been suggested, Meeker believes that the ideal operation will never be invented since no operation can be applied to all cases, yet many operators feel that their operation is the only one that should be performed in all cases. He states that the extraperitoneal shortening of the round ligaments should be condemned as it is based on a faulty principle. Were the round ligaments swinging free in the pelvis, traction on the distal part of the ligaments would draw the uterus upward as well as forward, but such is not the case. The round ligaments are covered by peritoneum which is attached to the ligament and neighboring structures by loose connective tissue; its attachment to the pelvic viscera mesially and its blend with the parietal peritoneum laterally, limit its mobility. Therefore the peritoneum acts as an elastic tunnel, through which the round ligament may be drawn for a short distance. Inasmuch as there is a continuous downward pull of this tunnel and its mid-portion is at a lower level than the uterine fundus, traction on the round ligament through the internal abdominal ring must pull the uterus forward and downward and thus increase the prolapsus. Intra-abdominal reefing of the round ligaments has the same fault mechanically as the Alexander type of operation, because the mid-portion of the round ligament is at a lower level than the fundus and internal ring which form the two points of counter tug, therefore the uterus must be pulled downward and forward. The Coffey and Baldy-Webster operations are not open to this objection, since by transplanting the mid-portion of the round ligament, the uterine attachment is at a lower level than the internal ring, thus drawing the uterus upward and forward.

**Normal Position of the Uterus.** In order to determine the actual position of the uterus and vagina and their relations to the surrounding

<sup>1</sup> American Journal of Obstetrics, 1915, lxxi, 458.

structures in a normal female, Bissell<sup>1</sup> placed metal stems in the uterine canal and metal strips in the vagina of patients and then had them radiographed while in the erect position. From the completed plates he computed the angle which the uterus forms with the horizon and also the relative position of the vagina. In the normal nulliparous woman with the bladder and lower bowel empty, the vagina forms an angle of 144 degrees with the horizon, while the normal uterus forms an angle of 54 degrees with the vagina and an angle of 16 degrees with the horizon.

**The Effect on Labor of Operations for Retroversion.** Kosmak<sup>2</sup> studied the effect on subsequent labors of operations of all types that were performed for the correction of uterine displacements and in reporting his observations, divides the cases into three groups.

Group 1. After a Kelly or Gilliam suspension operation, there is usually difficulty in engagement of the head, but after it has once engaged, everything progresses normally.

Group 2. After ventrofixation or other operation in which the uterus becomes adherent to the abdominal wall, the dystocia is more serious, and frequently an operative delivery must be performed in order to avoid dangerous consequences to the mother.

Group 3. If the interposition operation (Watkins-Wertheim) is performed without sterilizing the patient at the same time, the patient will, in the event of a subsequent pregnancy, require a Cesarean section for delivery. He cites a case of this type in which a Cesarean operation was performed and the patient again became pregnant; a dilatation and curettage was then performed and the tubes were resected as a matter of safety for the patient. Kosmak quotes various authors on this subject and the consensus of opinion seems to be that there is always a danger in performing a fixation of the uterus in a woman in the child-bearing age.

**Traumatic Displacement of the Uterus.** Trauma has been conceded as a possible cause of uterine displacement for a long time, but that it is rare in comparison with the other etiological factors is the opinion of most writers. The reasons for this apparent rarity are (1) because of the great difficulty of deciding whether the displacement existed before the accident, and, (2) because the symptoms are often misleading and the condition overlooked. Barringer<sup>3</sup> reports 6 cases of acute traumatic displacement of the uterus which she has seen during the past ten years and which she believes are undoubted cases. The trauma which caused the displacement was of three types: falls on the back or side in the supine position, sudden falls in the sitting position, and

<sup>1</sup> American Journal of Obstetrics, 1915, lxxi, 561.

<sup>2</sup> Bulletin of Lying-In Hospital, 1915, x, 52.

<sup>3</sup> American Journal of Obstetrics, 1915, lxxi, 758.

sudden unexpected strains, where intra-abdominal pressure is enormously increased, as in lifting and pulling.

The symptomatology of these cases consists of pain in the lower portion of the back over the sacrum and coccyx, sometimes sharp pains in the lower abdomen, occasionally a dull ache which radiates down the anterior aspect of the thigh. There is more or less bladder irritability consisting of marked frequency and urgency of urination. There is apt to be a change in the type of menstruation varying from amenorrhea to painful, prolonged menses occurring too frequently. In addition to these symptoms, there is a characteristic posture and gait, in which the shoulders are stooped forward, with the head carried slightly forward, and the dorsal and lumbar spine held in a position of slight kyphosis. The vaginal findings consist of various degrees of retroversion, retroflexion and prolapse.

In considering the treatment of this type of case, we must remember that the importance of early diagnosis is very great on account of subsequent congestion and further sequellæ. The reduction of the retroversion soon after the accident is easy, as a rule, and probably best effected in the knee-chest position. The uterus will sometimes snap back into place and remain there, the discomfort ceasing immediately. If the uterus has remained out of position for a longer time, the difficulty of non-operative cure depends on the length of time that it has been out of place.

**Prolapse of the Uterus** is in reality a form of hernia. As prolapse begins, most uteri assume the retroverted position, although in about 25 per cent. of women, the uterus is found in retroversion without causing any symptoms. In the treatment of prolapse with relaxation of the pelvic floor, if the symptoms are mild and there are no other intra-abdominal complications, Mayo<sup>1</sup> performs the simple Alexander operation, but if the condition is associated with some other intra-abdominal or pelvic lesions, an abdominal section had better be performed. In patients between fifty and sixty-five years of age, where a hysterectomy has been done without successfully supporting the cervical stump or vaginal terminus, prolapse of the vagina, with cystocele and rectocele, may develop from six months to ten years after the operation. Some of these cases are best relieved by total extirpation of the vaginal mucosa with complete closure of the vaginal outlet, by an extensive restoration of the perineum, leaving exposed only a small area of mucosa around the urethra. The interposition operation is very efficient in the relief of partial uterine prolapse associated with extensive cystocele, and the best results with this operation are obtained in cases in which there is a firm uterus which does not come out of the vagina in the anteverted position at operation. It relieves cystocele

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 253.

and prolapse of the first and second degrees, but should not be chosen in prolapse of the third and fourth degrees. If the operation is done before the menopause, it is advisable to divide and invaginate the tubes at the uterine cornua to prevent any possibility of pregnancy. In cases

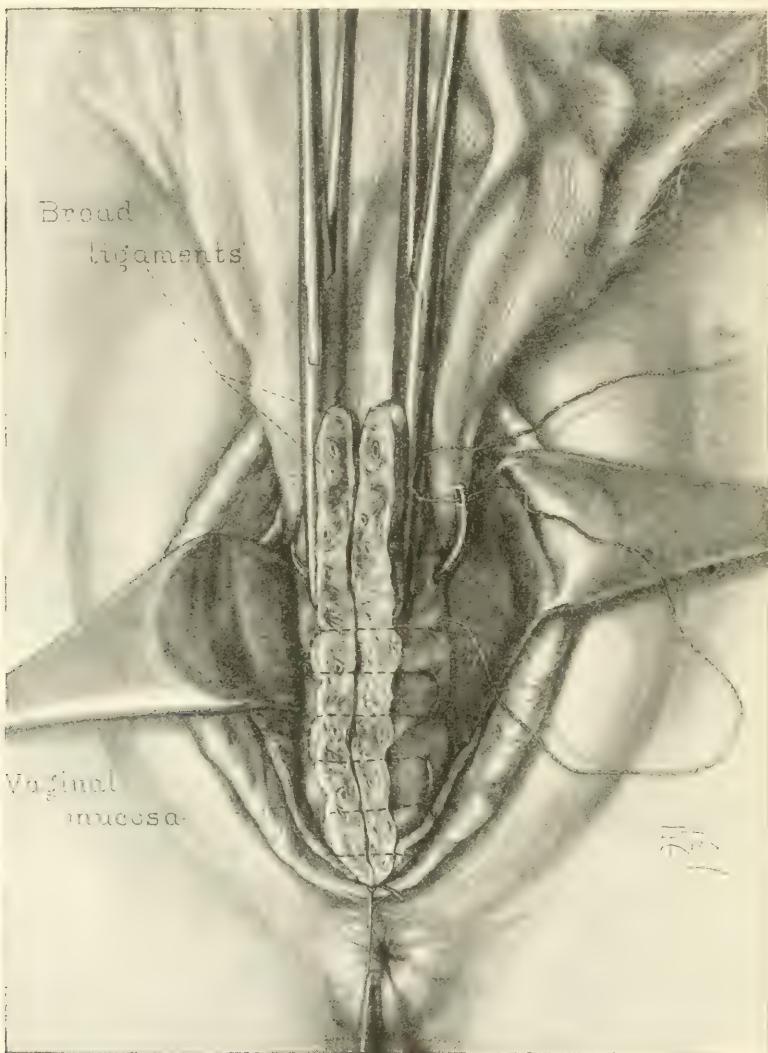


FIG. 100.—Broad ligaments approximated by running mattress suture. (Mayo.)

in which the cervix is grasped and pushed well up and, while in this position, it is noted that the cystocele is greatly reduced, some form of uterine suspension is the proper operation. On account of the difficulty of fixing the fundus of the uterus to the abdominal wall without the

sutures pulling out or the formation of new suspensory ligaments, Mayo has devised a special technic for cases of this type. The uterus is drawn through the abdominal incision and bisected anteriorly and posteriorly down to the internal os. Each half is turned outward and all of the mucosa above the internal os is dissected off, leaving only about a half thickness of the uterine wall. The peritoneum of the abdominal incision and the recti muscles are sutured all around the uterus at the level of the internal os, and the aponeurosis is separated from the recti muscles opposite the projecting uterus. Each half of the uterus is turned outward over the rectus muscle and underneath the aponeurosis to which they are sutured by using three mattress sutures on each side, not drawing the sutures very tight as the uterine muscle cuts very easily. The abdomen is closed without drainage. In this operation, the tubes should always be divided as a preliminary procedure. In very extensive cases of prolapse in women past middle life in whom the preceding operation is not indicated, Mayo performs a vaginal hysterectomy, leaving the adnexa, if possible, and then brings the broad ligaments together in the mid-line, having each broad ligament in the grasp of two hemostatic forceps. The forceps are approximated laterally and a running mattress suture of chromic catgut is applied, which passes back and forth behind the forceps, completely through both broad ligaments at such a distance as to tighten them, securing an approximation of 1 to  $1\frac{1}{2}$  inches. The method of suture is applied so as to interlock and prevent slipping inward of any vessels. When the suturing reaches the round ligament, it is caught in the angle of the dissection where the bladder has been separated from the anterior vaginal wall. The suturing extends backward on each side from this point, catching into the broad ligaments and then on each side into the angle of the depth of the dissection, thus compelling the bladder to rest on the broad ligaments. The loose ends of the exposed broad ligaments are now approximated by a running buttonhole stitch extending back toward the perineum, and the vaginal flaps are closed by a submucous stitch. By this operation, the complete elevation of the bladder is secured and it rests on the broad ligaments which make a complete transverse pelvic support. Perineal restoration is, of course, included in all operations for prolapse.

ANOTHER NEW VENTROFIXATION has been invented by O'Conor,<sup>1</sup> who states that the dominant factor in uterine prolapse is the relaxation of the cervical attachments, therefore an operation for the correction of a prolapse should fix the cervix. In his operation, after opening the abdomen and dealing with any complications that may be present, the uterus is drawn well up into the wound and a transverse incision is made through the uterine peritoneum, just above and parallel to the uterovesical reflection. The peritoneum, with the bladder, is retracted

<sup>1</sup> Annals of Surgery, 1915, lxii, 479.

downward and forward until a space of about one inch square is left denuded on the anterior surface of the cervix. The uterine peritoneum,

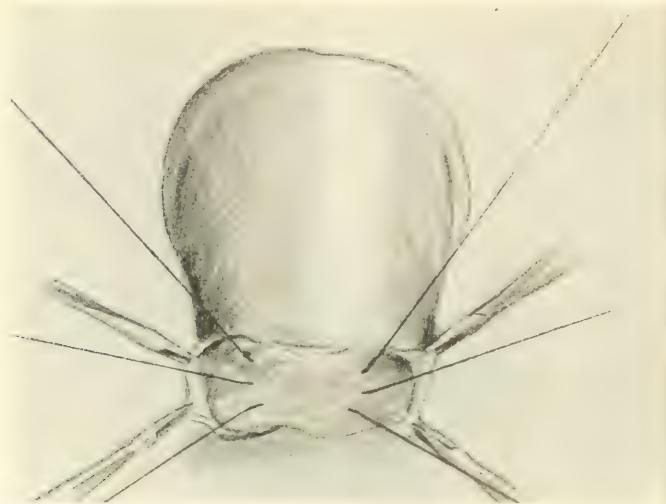


FIG. 101.—(O'Conor.)



FIG. 102.—(O'Conor.)

on each side of the exposed area, is retracted and three strong catgut sutures are passed, about one-third or an inch apart, through the exposed portion of the cervix and sufficiently deep to obtain a firm grip on the

cervical muscular coat. The ends of the suture are drawn out on each side through the recti muscles by a Childe's ligature forceps. Thus the peritoneum is excluded and the exposed surface of the cervix is brought into direct apposition with the recti. The wound is closed by tier sutures, the first suture purposely including the uterine peritoneum well above the denuded area.

INVETERATE PROLAPSE OF THE UTERUS, either primary or recurring after one or more previous operations is one of the most difficult conditions that the gynecologist is called upon to meet and, at times is apt to tax his knowledge and skill to the utmost. A rather unique method of dealing with this type of case has been elaborated by Walbaum.<sup>1</sup> The technic consists of making an elliptical denudation of the anterior vaginal wall extending from the urethral meatus almost to the cervix and another three-cornered denudation on the posterior wall (Hegar type). The edges of both of these denudations are undermined slightly, the bladder and rectum pushed back and reefed in, and then the edges of the denudation on the anterior wall are united to the corresponding edges on the posterior wall, so that the bladder and rectum are in apposition. In this way a broad septum is made in the vagina, extending from the cervix to the urethral meatus, which prevents the uterus from coming down, but at the same time permits of the drainage of the natural or abnormal secretions from the uterus.

**Pharmacology of the Human Uterus.** Two years ago we referred to some experiments which had been made by Lieb<sup>2</sup> to determine the action of various drugs upon the uterine muscle, using as the object of his experiments, strips of muscle from the uterus of a guinea-pig. In his latest publication,<sup>3</sup> he states that he is now using strips of uteri freshly removed at the operating table from the human; these strips are preserved in Ringer's solution until ready to be tested. The results of his experiments show that the normal non-pregnant uterus exhibits slow but powerful contractions which may be regular or irregular. These contractions vary from 10 to 60 per hour, differing markedly from the Fallopian tubes which contract between 120 and 200 times per hour. This shows that although the uterine musculature may be influenced by the nervous system, it is not wholly dependent upon neurogenic stimuli, but there must always be a myogenic factor acting. The effect of adrenalin on the muscle of the uterus was to cause a very transitory increase in the power of the uterine contraction; ergotoxin, in large doses, caused marked increase in uterine tonus, almost approaching tetanus. The interesting feature of the experiments was that while pituitrin produced a marked effect upon segments of pregnant uterus, causing feeble and slow contractions to become strong and rapid,

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 35, 614.

<sup>2</sup> PROGRESSIVE MEDICINE, June, 1914, p. 240.

<sup>3</sup> American Journal of Obstetrics, 1915, Ixxi, 209.

the effects of the drug on the non-pregnant uterus were rather surprising in that small quantities produced no effect whatever as a rule, while larger doses, such as caused marked stimulation in the pregnant uterus, caused either no change or else a depression in the condition of the musculature. The only explanation which Lieb offers for this curious phenomenon is that some unknown substance sensitizes the uterus, during pregnancy, to the action of pituitrin.

**Artificial Fertilization in Women.** Prochownick<sup>1</sup> was consulted by five married couples for sterility, in whom the male partner had a congenital anomaly, in 4 cases hypospadias and in the other, epispadias. The case of epispadias and one of the cases of hypospadias are not considered in the report since they both were sterile as a result of a previous epididymitis. In one of the three remaining cases, the man was advised to catch the semen on a sponge as it was ejaculated and then place the sponge in the vagina and at a subsequent coitus, to press the sponge with the penis and squeeze out the contents in the vicinity of the external os of the cervix. This was done, and in two months time conception took place. In the same manner, this couple have their second child after two and one-half years. In a second case in which this method was tried, there was no result and the woman would not permit any further experiments to be performed. In a third case, the man had had a hypospadias repaired some years before, but the urethra was very lax and in one part bulged out into a diverticulum so that when he had intercourse, the semen collected in this pouch and he had to milk it out with his fingers. In this case Prochownick carried out the Sims technic of artificial fecundation a few days before a menstrual period, and conception occurred after the second treatment. He has experimented with artificial fecundation in various types of sterility and although the results are not startling in any way, he derives enough encouragement from a successful case now and then to further him in his work. The technic, in brief, consists in collecting the semen, in a condom at the time of intercourse, draw the semen into a Braun's intra-uterine syringe and injecting about  $\frac{1}{2}$  c.c. into the uterus, the remainder of the semen being placed on a gauze sponge and pressed against the external os. At the end of an hour, or an hour and a half the gauze is removed. Of course, all of these manipulations must be performed under aseptic precautions and the most favorable time to perform this operation seems to be between the fifteenth and twenty-second day after the beginning of a menstrual period.

**X-ray Diagnosis in Gynecology.** In order to take advantage of the Röntgen ray in making a diagnosis of abnormal conditions in the uterus, Rubin<sup>2</sup> has suggested the idea of injecting an opaque substance (collargol) into the uterine cavity and then making a röntgenogram of the

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 10, 145.

<sup>2</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 435.

pelvis. The possible dangers of this method are that the fluid may run through the tubes into the peritoneal cavity, possibly carrying infective material with it and causing a peritonitis, while even aseptic material may cause an aseptic, adhesive localized peritonitis. The first objection is met by selecting the cases, not trying the method on cases in which there is an infection of the uterus or tubes. He did some experimental work on rabbits and proved that the collargol itself in the amount used, was not toxic even in the event of its passing into the peritoneal cavity.

*Technic.* The patient is placed on her back on the x-ray table, knees flexed and separated; a bivalve speculum is inserted into the vagina and the cervix is exposed, cleaned and painted with iodine. The anterior lip of the cervix is grasped with a tenaculum and a sound introduced into the uterine cavity in order to get an idea of its size and position. The nozzle of a Braun intra-uterine syringe is introduced just beyond the internal os and a Record barrel containing 5 c.c. of collargol is attached. The x-ray plate is placed under the sacral region of the patient and the picture taken as the fluid is introduced without pressure, 3 mm. of mercury being all the pressure that is required. When the fluid is observed to flow out of the uterus alongside of the nozzle, the injection is stopped and the excess is wiped away. The speculum is partially withdrawn so as not to interfere with the collargol shadow and the picture is taken. An attempt should then be made to recover the fluid that has been injected, by means of suction with the syringe; in some cases more than half of the fluid can be recovered, the remainder being discharged within the following twenty-four hours. Should there be pain at any time, it is advisable to stop the injection, as pain denotes distention of the uterus or tube, or escape of fluid into the peritoneal cavity. From his experience, Rubin has learned that with the tubes occluded, the injection is safe, while if the tubes are patent, the fluid may run into the peritoneal cavity without causing appreciable peritoneal irritation. The best results are obtained by using a 10 per cent. collargol solution, not injecting more than 5 c.c. in the average case. Rubin believes that the method will be of aid in the diagnosis of patency or occlusion of the tubes, in differentiating intra- from extra-uterine tumors, in certain uterine malformations, and in determining whether a single or bilateral salpingectomy has been done on a patient that has had a previous operation.

**New Method of Suturing the Cervix.** In order to avoid an uneven or irregular closure of the flaps after amputation of the cervix, Heineberg<sup>1</sup> has devised the following technic: A chromic catgut suture which is called the *traction suture*, is armed at each end with a well curved needle. Each needle is passed through the anterior flap about  $\frac{1}{4}$  inch

<sup>1</sup> American Journal of Obstetrics, 1915, lxxi, 751.

from its edge on the raw surface and about  $\frac{1}{8}$  inch on each side of the median line. These needles emerge about the same distance from the edge on the vaginal or mucous surface. They are then introduced through the base of the flap at the junction of the raw surface and the

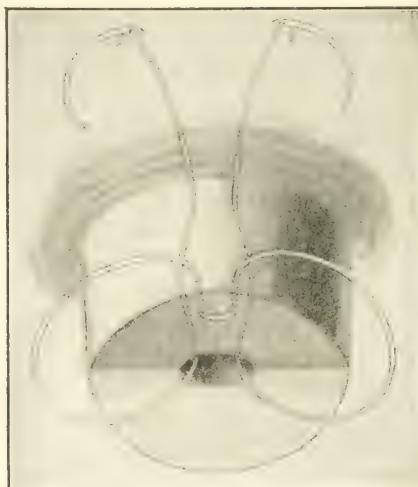


FIG. 103.—Method of introducing the traction suture in the anterior lip of the cervix. (Heineberg.)

mucous membrane of the cervical canal. They are passed through the entire thickness of the lip of the cervix and made to emerge upon the vaginal surface about  $\frac{3}{4}$  inch above the edge of the flap and about  $\frac{1}{4}$  inch apart. After sufficient traction has been applied to the ends of the



FIG. 104.—Method of introducing the mattress sutures. (Heineberg.)

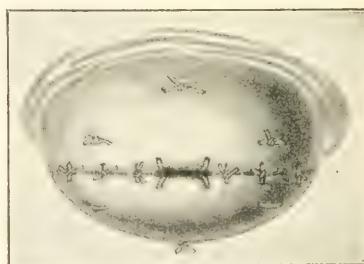


FIG. 105.—Method of introducing the superficial sutures. (Heineberg.)

suture to invert the flap, they are tied to each other. The posterior lip is sutured in the same manner and the lateral parts of the flaps are brought together by a mattress suture on each side and the edges are then approximated by superficial sutures of catgut.

**Three-bladed Uterine Curette.** For the purpose of eliminating the dangers and disadvantages of the ordinary curette, Romeo<sup>1</sup> has designed a curette with three blades arranged in stepping formation along the convex side of the instrument, so that in the performance of a curettage, the blades will simultaneously engage on the concave surface of the uterus. He has used the instrument in many cases and believes that it is of great aid in separating retained secundines; moreover, on account of its three points of contact, it greatly lessens the chance of perforation of the uterus.

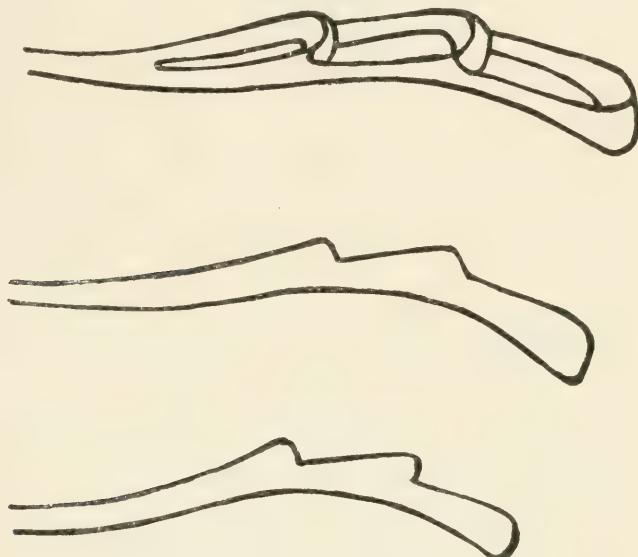


FIG. 106

#### THE FALLOPIAN TUBES.

**Ectopic Pregnancy.** A most satisfactory report has been presented by Polak,<sup>2</sup> showing how certain refinements in preoperative technic are making the mortality in ectopic pregnancy approach the vanishing point. In a series of 227 cases which were operated upon since 1900, there were only four deaths, three of which were due to peritonitis and one to hemorrhage. In this latter case, there was an intraligamentous rupture of a pregnancy in the isthmic portion of the tube, the ovum continuing its intraligamentous growth for several weeks and eroding itself into the uterine artery. A vaginal incision was made and death occurred on the table from hemorrhage before the abdomen could be opened and the bleeding checked. The histories of the cases in this series show that ectopic pregnancy occurs in three classes of women:

<sup>1</sup> Medical Record, 1915, lxxxvii, 103.

<sup>2</sup> American Journal of Obstetrics, 1915, lxxi, 946.

1. In women where pregnancy has been preceded by a varying period of sterility associated with dysmenorrhea due to a congenital uterine anomaly, with no history of infection.
2. In women in whom the tubal lumen has been disturbed by a previous infective process, giving a history since marriage of chronic pelvic inflammatory trouble.
3. In women who are subjects of rapidly recurring and repeated pregnancies, as may be found in our foreign population, particularly the Jews, Italians and Irish.

With regard to the clinical history of the cases in this series, it is of interest to note that pelvic pain was absent in only one patient, and abdominal soreness from distention of the tube and peritoneal irritation occasioned by the extravasation of blood was usually complained of. Metrorrhagia or menstrual anomalies were constantly present in over 98 per cent. of the cases before final rupture. The question of when to operate and what to do at operation has not been settled with any sort of uniformity by surgeons at large, so that it will be of considerable interest to note the rules which Polak has followed with such excellent results.

In unruptured cases, the tube is incised, and the pregnancy evacuated or the tube is extirpated as soon as the diagnosis is made. In the ruptured cases, in the tragic stage, presenting symptoms of shock, it is his custom to postpone the operation until after reaction has taken place, keeping the patient under constant and intelligent observation. On admission, the patient is placed in the extreme Trendelenburg posture and her pulse is carefully counted and recorded; she is then given a hypodermic injection of morphine sulphate gr.  $\frac{1}{4}$  to  $\frac{3}{8}$  without atropin, which may be repeated on the first sign of restlessness. The pulse is taken and recorded every fifteen minutes and the blood-pressure is recorded every hour. Neither saline solution nor stimulation are given. Under this plan, in the course of a few hours, apparent changes are noted. As a rule, the pulse improves in quality, becomes slower in rate and the blood-pressure gradually rises. Water is given freely by mouth if it is not vomited. In this series of cases, there has not been one that has failed to improve under this plan of watchful waiting. Repeated blood examinations are made to determine the hemoglobin percentage and the number of red cells, thus showing whether the bleeding is continuing or has ceased. When reaction has taken place, as shown by slowing of the pulse, the rate usually falling to below 120, an increase in its volume, and a rise in blood-pressure to 115 mm. or more, it is time to operate, which should be done with as little disturbance as possible. The operation is preceded by another injection of a quarter grain of morphine and then novocaine spinal anesthesia is employed. If further anesthesia is necessary, ether and oxygen may be added. At the completion of the operation, one quart of normal saline solution is left in the abdomen and the wound is closed in layers, supported by

retention sutures of silkworm gut. Polak discontinued the use of saline infusions some years ago owing to the unfortunate results following its use in the service of one of his colleagues, who was so unfortunate as to lose three ectopic patients in succession from pulmonary edema, in whom infusion had been employed immediately after the operation. It is but reasonable to suppose that a heart that has adjusted itself to an empty blood stream is hardly competent to carry the amount of saline solution that is forced upon it by the energy of some operators. Nature seems competent to take what fluid it needs from the saline left in the abdomen, which mixes with the blood already there and is absorbed, or from the rectum by a Murphy drip, without embarrassing the cardiac function. No drainage has been used except in infected hematoceles.

In order to determine the influence of curettage in checking the uterine hemorrhage, which is so apt to continue for a long time after an ectopic pregnancy, Polak curetted a series of cases and at the same time noted whether a corpus luteum cyst was present and checked these cases with a series not curetted, also noting whether or not a corpus luteum cyst was present. From these observations he had concluded that curetting has no influence on this form of metrorrhagia, but that it is controlled wholly by the presence or absence of a corpus luteum cyst, for in the cases in which no cyst was found, the bleeding promptly ceased.

A STATISTICAL STUDY OF ECTOPIC GESTATION has been carried out by Hada<sup>1</sup> in the hospital at Sapporo, Japan. He has treated 79 cases, of which 77 terminated within the first three months of pregnancy, while 2 cases continued until the tenth month. The average number of pregnancies to each patient was 1.7 which is somewhat lower than that reported by other men. Most cases occur in nulliparae or primiparae, and very few in multiparae. The average age of the patients at the time of consultation was 30.2 years, and the average period of time since the last pregnancy was 6.1 years. After the operation, two women again had a tubal pregnancy, while three women had a normal pregnancy. A differentiation between tubal rupture and tubal abortion is not possible in some cases, but it was found that there were more abortions during the first two months of pregnancy while there were more ruptures during the third month; as a whole, the ratio is 1.8 abortions to 1 rupture. These figures apply only to the frank clinical cases; if, however, concealed ruptures are taken into account, there would be more ruptures than abortions, since many of the cases which terminated clinically as abortion, showed, on later examination, that the tube was the seat of a concealed rupture. Free hemorrhage occurs in 34.5 per cent. of tubal abortions and in 56 per cent. of tubal ruptures. The treatment of the opposite tube in these cases still remains

<sup>1</sup> Monatschr. Geburtsh. u. Gynäk., 1915, xli, 198.

debatable, but Hada believes that it should be conserved, especially if the patient is desirous of having children, since the chances of a future normal pregnancy are from 6 to 24 per cent., while the chances for the development of another ectopic pregnancy are only from 2 to 6 per cent.

RARE FORMS OF ECTOPIC PREGNANCY. Pregnancy outside of the uterus may assume such diverse clinical aspects and cause such peculiar physical signs, that it may be worth while to call attention to two or three interesting case histories that have been presented since our last publication. Johnson<sup>1</sup> reports the case of a married woman, forty-one years old, who complained of abdominal pain of four days' duration, situated above the pubis on both sides and colicky in nature; pulse, 76, temperature, 98.2° F. There had been no vomiting nor obvious physical signs except some slight tenderness and resistance to pressure in the lower abdomen on either side. Menstruation, previously regular, had ceased ten weeks before "as a result of a severe chill" contracted at the time the monthly period was due. Although the patient had been married fourteen years she had never been pregnant, and there were no changes in the breasts nor other signs of pregnancy. Two days later, an indefinite mass was felt in the left iliac fossa on deep pressure, and per vaginam a considerable swelling was felt to the left of, and behind, the uterus, and there was a boggy feeling in Douglass's pouch, but there were no changes in the general condition except that the pain became more severe. At operation, the left tube was found ruptured and bleeding, and the right tube was congested and closed at the fimbriated extremity by a thick deposit of lymph. Two feti of about ten weeks, were found in the peritoneal cavity with a single large placenta and a quantity of blood clot. The operation was completed as usual, and the convalescence was uneventful. The points of interest in this case are that there was a twin ectopic pregnancy and that there was no vaginal bleeding until after the completion of the operation. Another case of twin pregnancy, in which an extra-uterine pregnancy was associated with an intra-uterine pregnancy, was reported by Macfarlane.<sup>2</sup> In this case there was a history suggestive of ectopic pregnancy, and, on examination, an enlarged uterus was found in retroposition and a semifluctuant mass in the pouch of Douglass. At operation, there was a pelvic hematocele the result of a tubal abortion on the right side. Both tubes were diseased and were removed with both ovaries, each of which contained a corpus luteum, but despite the removal of both corpora lutea, the intra-uterine pregnancy proceeded to full term. A third unusual case is that reported by Oden,<sup>3</sup> in which at a primary operation, a ruptured right tubal pregnancy and a gangrenous appendix were found and removed. The left tube was apparently normal and was allowed to remain. Five months later, the patient was operated

<sup>1</sup> Lancet, 1915, clxxxix, 869.

<sup>2</sup> Glasgow Medical Journal, 1915, lxxxiv, 109.

<sup>3</sup> Journal of Michigan State Medical Society, 1915, xiv, 104.

upon again and a ruptured left ectopic pregnancy was found. The patient had had two healthy children, seven and four years old respectively, and there was no history of any pelvic inflammation. In discussing the proper disposition of the healthy tube in these cases, Oden states that he removes it if the patient is a multipara and saves it if she is a primipara, with the hope that she will have a future normal pregnancy.

**A New Method of Sterilization.** There are many cases in which it may be advisable to sterilize a woman in whom the pelvic organs are normal, as in cases of pulmonary tuberculosis, grave cardiac disease and various psychoses. In such cases, the removal of the ovaries is out of the question because of the many disadvantages of depriving the woman of the internal secretion of the ovary. Whether the tubes or uterus are to be removed, depends on whether we desire menstruation to continue or not. It is usually best to perpetuate menstruation, because, even though the woman is sterilized, she is not subjected to much of a psychic shock if she still continues to have the subjective evidence of normal pelvic organs. In applying sterilizing operations to the tubes, we have a choice between resection of both tubes or else removal of a section from the middle of each tube. This can be done *per vaginam*, if desired, as an accessory to the Wertheim interposition operation when the woman is still in the child-bearing period or when other vaginal operations are being performed, but, as a rule, it is easier and better to perform it by laparotomy. Since 1897, there have been several methods described by means of which the tube can be temporarily closed, so that if conception is desired later, a simple operation can restore the permeability of the organ. Stöckel<sup>1</sup> reports a case in which a woman had five children in five years, and, after each of the last two, she was severely affected by a psychosis. The consultant neurologist cautioned against further pregnancy and the thought that she would never have the possibility of another child worried the woman as much as the danger of having one. She begged Stöckel to perform an operation that would only temporarily sterilize her. This was done in the following manner: The inguinal canal was opened as in the Alexander operation, the canal of Nuck incised and the peritoneal cavity entered. The tube was brought out with a pair of forceps and the peritoneum brought together behind the outer two-thirds of the tube by means of a suture which also included the serosa of the tube. The tube was then placed between the muscle and fascia of the abdominal wall in the inguinal region and the wound was closed. By this means, he prevented further conception but thus far he has not replaced the tube in the abdominal cavity to see if conception is possible on account of the danger of conception in this particular case. There should be no trouble technically in replacing the tube and the chance of further conception should be very good as the structure of the tube is not altered by being placed extraperitoneally.

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 11, 161.

Although Stöckel cannot cite any examples in which pregnancy occurred after replacing the tube, on account of lack of material, the advantages which he claims for the operation are the simplicity of technic, the small inconspicuous scars, no ligatures or stumps are left in the peritoneal cavity, thus diminishing the possibility of adhesions, shortening of the intraperitoneal phase of the operation and a safer method of disposing of the tube.

**Clinical Results of Salpingostomy.** In 1885, Martin began to popularize the operation of salpingostomy, which consists of a plastic procedure on a closed tube, so as to make a new opening, and thus favor the possibility of a future conception. He performed the operation in 65 patients and later traced 47 of them, but in only 2 had conception occurred. The operative results themselves were good, since in no case was a secondary operation on the remaining stump of the tube necessary. Thaler reported 16 cases which were done in as many years in the Vienna clinic, 9 of which were traced, and in 2 of them pregnancy had occurred shortly after the operation. Bumm has had 3 patients conceive after performing salpingostomy on them. Kehrer reported a case in 1909, in which the right adnexa was removed for tubal pregnancy and a salpingostomy performed on the left tube. This patient later conceived and went to full term. The contraindications to the operation are pus tubes, and gonorrhreal or tuberculous disease of the tubes. Several observers have had to reoperate after a salpingostomy to remove the stump upon which the plastic operation was done and which had become a pyosalpinx or else the seat of a tubal pregnancy. Some surgeons refuse to perform the operation for fear of infection from the uterus travelling out through the newly opened tube, and infecting the abdominal cavity.

Löhnberg<sup>1</sup> reports on 21 cases performed in the clinic at the Köln Academy where he is associated, between May, 1908, and July, 1913. His views are that the operation is indicated in chronic inflammatory changes in the tubal mucosa without marked changes in the wall of the tube, and in moderate degrees of hydrosalpinx, but is heartily in accord with other observers on the absolute contraindication of opening a pyosalpinx. In cases of extra-uterine pregnancy, the question often arises at the operating table as to the advisability of performing a salpingostomy on the opposite tube if it is closed. Although his material is large, and he has had quite a number of cases of ectopic pregnancy cases to operate upon, he had not had the opportunity of performing a salpingostomy on the opposite tube, either because it was already open or because it was not considered justifiable to open it on account of its pathology. Moreover, in many instances, time is an important factor and unless the general condition of the patient is fairly good, it is not justifiable to consume time by operating on the opposite tube.

<sup>1</sup> Monatschr. f. Geburtsh. u. Gynäk., 1915, xli, 62.

In cases of this type, where salpingostomy is performed at the same time that an extra-uterine pregnancy is removed from the opposite side, the remaining tube seems to be predisposed to be the seat of another tubal pregnancy, since the tubal mucosa seems to have a tendency to imbed the ova as they pass. No case is known, however, in which a tubal pregnancy has occurred in a tube upon which a salpingostomy had been previously performed, except in patients who had previously had tubal trouble, so that the danger of the operation itself has been exaggerated. In two patients, Löhnberg had the opportunity of seeing the results of the operations by means of second laparotomies performed some time later for other conditions. In both cases the tubes were found closed again, but not markedly changed in structure or adherent. All of the operations in this series were performed in women under thirty years of age and the history showed absolute sterility in 4, 2 of whom were unmarried; sterility after abortion in 5; one child sterility in 9; 2 were pregnant twice and 1 was pregnant three times. In 20 patients the abdominal method was used, and in 1 patient the vaginal operation was performed. Various methods were tried, such as resection of the end of the tube or cutting a window in the tube. The mucosa should be stitched to the serosa and the ovary stitched to the newly formed opening and then the ovary should be stitched to the pelvic wall, if necessary, to suspend it in order to keep it from prolapsing into Douglass' pouch. He has traced 14 of his patients but none has had either a normal or a tubal pregnancy, but he believes that the failures are due to tubal changes and not to errors in technic because the new opening usually closes again shortly after the operation. In conclusion, he believes that the operation is of advantage:

1. As a pure sterility operation, if from the history and findings we suspect a closure of the abdominal ostium of the tube due to inflammatory processes in adjacent organs, and providing that the sexual ability of the male partner is known to be all right.

2. As a conservative adnexal operation in cases of closure of the tube from chronic salpingitis or perisalpingitis, or due to appendicular adhesions, especially with a view of preserving the possibility of pregnancy in young women and occasionally, where pregnancy is greatly desired, in patients who have been the subjects of an extra-uterine pregnancy.

**Treatment of Acute Pelvic Inflammations.** The subject of acute pelvic inflammatory disease has been extensively reviewed by Ward,<sup>1</sup> who classifies these cases under three heads etiologically.

1. Cases originating during labor or miscarriage.
2. Cases due to gonorrhea as a result of extension of the infection.
3. Cases due to infection from unclean instruments, as may occur during operations or treatments.

<sup>1</sup> American Journal of Obstetrics, 1915, lxxi, 881.

Suppurative parametritis and perimetritis, pyosalpinx, tubo-ovarian abscess, and isolated purulent collections in the pelvic cavity are commonly included under the term "pelvic abscess," and too frequently no attempt is made to differentiate them in making a diagnosis. The course of each type differs in its history, and a proper treatment and prognosis is dependent upon an intelligent understanding of the particular variety under consideration.

PARAMETRITIS OR PELVIC CELLULITIS means an inflammation of the pelvic connective tissue, and von Rosthorn has classified pelvic exudates into five groups as follows:

1. Lateral horizontal exudates, located in the bases of the broad ligaments, with a tendency to spread to the side walls of the pelvis and around the cervix. These usually originate from pelvic tears.

2. High intraligamentous infiltrations beginning near the cornua of the uterus, forming tumors rounded above, with a tendency to infold the broad ligaments and climb up into the iliac fossæ. This variety is usually due to an endometritis.

3. Exudates in the retrocervical connective tissue, with a tendency to spread posteriorly along the uterosacral ligaments or sink into the rectovaginal septum.

4. Exudates in the precervical tissues, spreading toward the sides around the uterus.

5. Exudates anterior to the bladder, behind the pubis, with a tendency to rise behind the recti muscles, sometimes as far as the umbilicus—the "plastron abdominal" of the French.

Several of these varieties may be combined, but the most common is the lateral, extending from the side of the uterus to the bony pelvic wall, then anteriorly around the ureter, raising up the peritoneum and appearing above Poupart's ligament. The pelvic peritoneum is always involved in the process, and the adnexa or intestines may be adherent to the pelvic mass. Consequently, it is frequently difficult to determine whether a parametritis or a perimetritis is the predominant lesion.

PERIMETRITIS OR PELVIC PERITONITIS results most frequently from an extension of a gonorrhœal or other septic infection from the endometrium through the tubes to the peritoneum, covering the adnexa, uterus, intestines and pelvic wall and enveloping these organs with a plastic exudate that later develops into adhesions. The infection may travel through the lymphatics of the broad ligaments and extend from a parametritis as has been mentioned.

TREATMENT. A symposium on the treatment of pelvic suppurative lesions was held at the International Congress of Obstetrics and Gynecology, in 1896, when a number of men advocated simple vaginal incision and drainage in preference to the abdominal route or a radical vaginal hysterectomy. In spite of this, the operation of colpotomy for

these conditions did not find much favor, and, in 1899, Schauta, in particular, was an ardent advocate of the total radical operation for acute suppurative disease and apparently he is so still. He then cited 216 cases operated upon in this manner, with 13 deaths. In 1912, Thaler, reporting the results in Schauta's clinic, stated that of 597 women who had been operated upon by this radical method, 343 were under thirty years of age. This seems a large proportion of young women to be subjected to a total extirpation of their sexual organs and consequently to be forever debarred from even the hope of maternity, when we consider the experience of other observers with the operation of simple colpotomy and drainage in these acute cases. While it is true that a certain proportion may have to have a secondary abdominal operation to relieve them of adherent adnexa, a surprisingly large number are cured of their symptoms and a not inconsiderable number bear children. Schauta says that it is impossible with the simple colpotomy incision to reach all the pockets in a case of pyosalpinx, and that, in his clinic, 25 per cent. of the cases so treated require a secondary operation.

In this country, Noble, in 1902, made a statistical study of the results of the treatment of pelvic suppurations in 200 cases. He found a mortality of 27 per cent. for the total abdominal operation as compared to a 1.8 per cent. mortality for treatment by simple vaginal incision and drainage.

Polak, in 1910, reported an important study of 200 cases of *puerperal sepsis*, of which 72 cases had peritonitic or parametritic exudates. He noted that those cases that had not been subjected to intra-uterine manipulations before entering the hospital seldom developed exudates. Of these 72 cases, 63 had been curetted one or more times before admission, and only 7 of the exudates terminated in suppuration, which is a strong argument for the expectant treatment. While it is evident that some of the authorities abroad employ the total radical abdominal or vaginal operation of extirpation for pelvic suppurations, in this country the majority of operators adopt the more rational procedure of simple incision and drainage, with the object of conserving the function of the organs and the weight of evidence at hand seems amply to justify this conservatism beyond dispute. In puerperal cases, we cannot do better than to follow the dictum of Polak: "Never disturb a local focus postpartum as long as the patient shows improvement, unless there is a definite evidence of localized pus." Large puerperal masses disappear wonderfully in a few weeks if let alone, but masses due to gonorrhreal infection do not disappear in the same way, but become chronic and produce disability. In the onset of acute gonorrhreal salpingitis, the same "let alone" policy is to be followed during the acute stages until positive evidence is present of the formation of a pelvic abscess, with symptoms of absorption sufficient to demand evacuation.

In the treatment of *pelvic cellulitis*, we desire to hasten absorption of the exudate and to prevent the spread of the infection and if suppuration occurs, to limit the spread of the abscess. Rest in bed is imperative to prevent the spread of the infection and to favor the absorption of the exudate. Frequent pelvic examinations are harmful, and intra-uterine manipulations are dangerous, while the use of the curette is undoubtedly one of the most potent causes of the formation of an exudate. Later, when the acute symptoms subside, an attempt to



FIG. 107.—(Ward.)

hasten the absorption of the exudate should be made by the use of the dry, hot-air bath or prolonged hot vaginal douches. In cases of perimetritis, the same line of treatment should be followed with the addition of the employment of the Fowler position, maintained most comfortably for the patient by the use of the Gatch frame, which converts the mattress into a comfortable steamer chair. At the first sign of

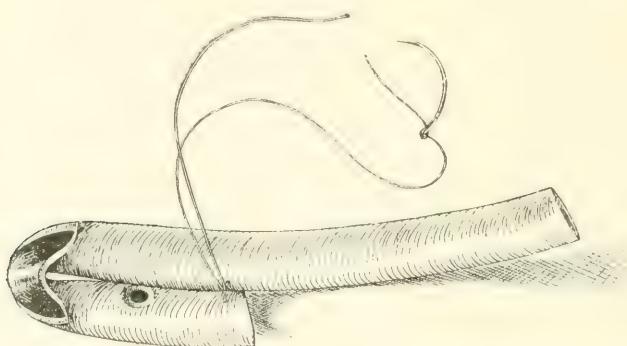


FIG. 108.—(Ward.)

involvement of the abdominal peritoneum, the Murphy drip should be employed.

In the operative treatment of these cases, the preliminary curettage is unnecessary and dangerous and it is to be condemned. A small incision is made in the vaginal vault in back of the cervix, the finger is introduced through the opening, and the abscess is located and ruptured by the finger. For draining these cases, Ward has had much satisfaction from a piece of rubber tubing of the diameter of the index finger and

about six or seven inches in length, which is cut with a large fenestra about two and a half inches from one end. Additional small openings may be made on the short end only. The tube is then bent at the centre of the large opening and the arms of the tube are sutured near the end of the short arm with a single silkworm gut suture, which is left long with a cervix needle attached. The doubled tube now has one short arm and one long arm and is inserted into the cavity to be drained, through the colpotomy opening, and the attached suture is passed through the posterior lip of the cervix and tied, thus securing the tube in position as long as desired. The long arm of the tube extends down to the vulva, where it may be readily exposed for the easy insertion of a nozzle of a syringe or an irrigating apparatus for the purpose of keeping the tube from being blocked with clots or débris, the return flow cleaning the short arm. It is unwise to irrigate the abscess cavity as there is danger of disseminating the infection, but an injection of salt solution, with just sufficient pressure and quantity to clear the tube, is used each day. A vaginal douche, under low pressure, of permanganate of potash will keep the tube and vagina clean. The tube should be left *in situ* until all drainage has ceased, but in cases in which there is not much pus, but extensive adhesions instead, gauze packing is preferable to the rubber tube.

**When to Operate in Inflammatory Disease.** At the meeting of the American Gynecological Society in 1915, the subject of when to operate in pelvic inflammatory disease was freely discussed, and, while the opinions of the members present were fairly uniform, Simpson<sup>1</sup> described in detail what he considered a precise method of choosing a safe time for operation in pelvic inflammation of tubal origin. His ideas have been crystallized by a critical study of a considerable series of cases (some thousands) and have been confirmed by a series of 856 consecutive abdominal operations done to provide relief from the results of tubal infection, with only 9 deaths, a mortality of only a little over 1 per cent. Such statistics are sufficient evidence that the principles that admitted of such a low mortality must have at least a degree of merit. In Simpson's judgment, the questions of mortality, of post-operative morbidity, and of the smoothness of convalescence, depend almost entirely, in competent hands, upon a strict adherence to the following postulates before subjecting the patient to operation:

1. The patient shall have recovered from her acute illness and shall have regained a satisfactory margin of reserve strength.
2. The temperature shall not have risen above normal a single time for a minimum period of three weeks.
3. There shall have been no marked or persistent rise of temperature following a careful bimanual examination.

<sup>1</sup> American Journal of Obstetrics, 1915, lxxii, 693.

4. The inflammatory exudate surrounding the focus of infection shall have been completely absorbed.

**Colpeurynter Massage in Parametritis.** Holz<sup>1</sup> reports on the excellent results that he has obtained in chronic inflammations in Douglass' pouch by means of his method of automatic massage. The method is extremely simple, and consists of introducing a colpeurynter or rubber bag into the vagina well up toward the cul-de-sac. The bag is then distended with water by means of a hand syringe, introducing between 50 and 100 c.c., the actual amount depending on the capacity of the vagina and the causation of pain. The amount should be just enough to cause the greatest distention of the colpeurynter without causing pain to the patient. The distended bag is left in the vagina for from one to three days, then removed, cleansed and replaced. Its action depends on its alternate distention and compression due to the respiratory and other movements of the patient and thus the adjacent parts are automatically massaged. In the course of a few weeks of such treatment, great improvement is noted and the patients have no further pain; the inflammatory material in Douglass' pouch disappears and the uterus and adnexa become movable. When this stage has been reached, a suspension of the uterus should be performed in order to hold the organ in anterior position, and, for this purpose, Holz prefers the Alexander operation, shortening the round ligaments as much as possible. He is so enthusiastic over the treatment that he believes that pregnancy will occur in many of the cases so treated.

**Superheated Air in Gynecology.** Gynecologists have neglected to properly utilize Bier's hyperemia treatment and have lost thereby, according to Walther,<sup>2</sup> whose experience has convinced him that superheated air is destined to an important position in the treatment of chronic pelvic trouble. With the exception of a few refractory cases, he obtained excellent results in chronic parametritis and perimetritis with all their consequences, in old gonorrhreal affections and in dysmenorrhea from functional ovarian disturbance. In 8 or 10 cases conception seems to have been favored by the hyperemia thus induced in the ovaries, so that he believes that the hot air treatment might well be given a trial in the treatment of sterility. The effect was always prompt in amenorrhea except when it was due to anomalies of development, and he gives the treatment a trial in all cases of amenorrhea with infantile uterus and has had excellent results. Chronic bladder disturbances, especially those secondary to displacements of the uterus, were favorably modified, the pain always subsiding. He never ventures this treatment in acute gynecologic affections nor in the febrile subacute; tuberculous abdominal processes and fevers from any cause always

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 26, 441.

<sup>2</sup> Deutsch. med. Wehnschr., 1915, xli, No. 32, by Journal of American Medical Association.

contraindicate the treatment. In some cases tumors become palpable under the treatment, when before they had been masked by a general tumefaction.

The most convenient method of applying the heat is by means of electric lights, covering the abdominal walls and thighs with a warmed, moist sheet which does away with the unpleasant action of the heat on the skin, while increasing its absorbent action, since it acts like a compress. The treatment is usually begun at a temperature of 60° to 70° C. and gradually increased in the following sittings to 100° C., and is always well borne. Success depends on an exact diagnosis, on positive exclusion of complications, having the treatment applied by the physician himself or by a trained person under his supervision, and having the patient in the hospital, never as an out-patient.

**Polypus of the Fallopian Tube.** This condition, although mentioned in text-books, is rarely encountered in pelvic surgery. It may exist without causing any symptoms and pass unrecognized until it reaches such a size that it is discovered by palpation during some routine pelvic examination, or until the occurrence of rupture of the containing tube demands operative procedure. Hoffman<sup>1</sup> reports an interesting case in which a polyp of the tube simulated an ectopic pregnancy. The patient was a married woman, thirty years old, who had never been pregnant and her menses had always been normal until the last period before consulting her physician. At that time, the period came at the expected time but lasted several days longer than usual, with one day's cessation, followed for a few days by a dark, bloody discharge with clots, accompanied by colic in the lower abdomen and slight abdominal distention. Upon examination about a week later, a boggy, semi-fluctuating mass was palpable in the cul-de-sac. The right adnexa was palpable but not abnormal, but a mass was felt in the left parametrium about 5 cm. in diameter, immobile, separable from the uterus, and tender. A diagnosis of ectopic gestation was made, and the patient was operated upon. When the peritoneal cavity was opened, some fluid, blood and clots escaped. The left adnexa was represented by a mass 5 cm. in diameter, embedded in blood clots and ruptured on its superior margin near its distal end and it was removed in the usual manner. The findings were considered to be due to an ectopic pregnancy until the pathologist reported that the condition was due to a polyp which was 2 cm. in diameter.

### THE OVARIES.

**Ovarian Transplantation.** Two years ago<sup>2</sup> mention was made of the work and enthusiastic reports of Tuffier in connection with the subject of ovarian transplantation. That he is still satisfied with his results

<sup>1</sup> Journal of American Medical Association, 1915, lxv, 1360.

<sup>2</sup> PROGRESSIVE MEDICINE, June, 1914, p. 248.

is evidenced by the fact that he continues to transplant ovaries and report on his cases. Writing from his experience of eight years, during which time he has performed ovarian transplantation over two hundred times, Tuffier<sup>1</sup> states that he has not had a single functional result in grafting an ovary from one patient to another. Most of his work has consisted of autografting, or the transplantation of the woman's own ovary, which he has done 144 times. The circumstances under which these operations were performed, are of two varieties. In total hysterectomy, he transplants one or both ovaries in whole or in part, and the grafts usually take and increase in size every month, but without any benefit to the patient. In cases of salpingitis, the uterus is left *in situ*, the adnexa are removed and one or both ovaries are grafted. The justification for this operation is the suppression of pain with the preservation of menstruation. After salpingectomy, the ovary may be left in the abdomen, may be grafted near the uterus or in some other place, as under the skin of the abdominal wall, but in these cases, the patients frequently complain of pain, and a second laparotomy is necessary to remove the ovary, so that Tuffier has now abandoned such procedures. His present technic consists of transplanting the ovary between the peritoneum of the abdominal wall and the overlying muscles. If the ovary is not aseptic, it should be dipped in tincture of iodine or passed through the flame of a lamp, though after this procedure the results are not so good, as the patients do not menstruate for a long time. If the ovary contains cysts, these should be incised before the ovary is grafted. In some cases, the gland is divided into equal parts and grafted separately in order to obtain smaller grafts and larger surfaces for adhesions. After transplantation, the ovary seems to lie dormant for three or four months and the patient has menopausal symptoms, but after a while the ovary enlarges, may become painful for a few days and all the menopausal symptoms subside, menstruation reappearing in five or ten days. Tuffier states that his results have been very gratifying and in the few patients in whom the menses have not become regular, either they were over forty years old or else they were septic cases and the ovaries had been dipped in iodine before grafting. The grafted ovary always becomes enlarged before each menstrual period, unless one ovary has been left in the abdomen, in which case, the menstrual flow is always dependent on the organ left *in situ*.

At the meeting of the American Gynecological Society at White Sulphur Springs in May, 1915, the subject of ovarian transplantation received considerable discussion, some of the members reporting very favorable results following the operation, while others could report nothing but failures. Simpson<sup>2</sup> has been working along these lines to a considerable extent and has elaborated an original technic. After

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 30.

<sup>2</sup> American Journal of Obstetrics, 1915, lxxii, 140.

removing the ovaries, a portion or all of the better one is kept in normal salt solution at body temperature until the operation proper is completed. Then a small incision is made through the skin about two inches inside of the anterior superior spine of the ilium. A pocket is made in the subcutaneous tissue by spreading a hemostatic forceps and, into this pocket, a section from the cortex of the ovary (about  $2 \times 2\frac{1}{2}$  cm.) is inserted and the skin closed by a plain catgut suture. In some cases, a transplantation is made on both sides. This particular location is chosen for the graft so that in case of infection or gangrene of the ovarian tissue, it could be removed by cutting one or two sutures; if the graft should become painful, it could be removed under a local anesthetic without performing a laparotomy. The blood supply in this location is comparatively good, since it comes from the deep epigastric arteries and protection is afforded the graft by the anterior superior spine of the ilium. If infection of the graft should occur, the abdominal wound will not be involved, so that this method is free from the dangers of intraperitoneal or retroperitoneal transplantation when there is a possibility that the graft is already infected.

Chalfant, who is associated with Simpson, states that while homoplastic transplantation is only rarely successful, autoplasic transplantation, for a time at least, is usually successful, and the onset of the menopause is prevented or delayed; but even in these autoplasic grafts, degeneration is common after a longer or shorter interval. In reviewing the 32 patients in whom transplantation has been performed in Simpson's clinic, he reaches the conclusions that subcutaneous transplantation of ovarian tissue does not increase the risk of operation. In the majority of patients, the graft persists for a time and in some cases it appears to functionate, as evidenced by the apparent development of Graafian follicles, by variation in size and tenderness, and, when the uterus remains, by menstruation. The presence of one ovary in the pelvis does not interfere with the success of the graft.

Martin<sup>1</sup> has made a thorough review of the literature on this subject and he states that, in the mind of an impartial observer, there must be a feeling of disappointment as to the surgical value of ovarian transplantation. Autotransplantation of ovarian tissue, as the operation is at present practised, retards and modifies the symptoms of the artificial menopause, that is precipitated by castration, in a definite number of cases, depending undoubtedly on the ability of the graft to retain its vitality in its new environment. The percentage of successful results seems to be as large where the simplest technic is employed, using small pieces of ovary tucked into pockets of well-vascularized tissue, as when a more complicated technic is employed, with an attempt to couple up the bloodvessels. The fact that homotransplants and heterotrans-

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 568.

plants are failures, made with the same technic that is employed for successful autotransplants, demonstrates that there is a definite antagonism between the tissues of different individuals of the same species and a prohibitive antagonism between the tissues of different species. Occasional reports of successful homotransplants and heterotransplants encourage one to hope that in some way this antagonism of tissue will be overcome, and more successful work may result because of the greater precision this would make possible in selecting more normal tissue.

**Radical versus Conservative Ovarian Surgery.** In previous years<sup>1</sup> we have considered, from time to time, the opinions of various surgeons in regard to the advisability of allowing the ovaries to remain after the performance of a hysterectomy. This question was also brought up at the meeting of the American Gynecological Society in 1915, and Vineberg<sup>2</sup> put himself on record as belonging to the radical group of surgeons in cases of this kind. He stated that there is still considerable uncertainty as to which tissue in the ovary is responsible for the production of the internal secretion. While it is established that the follicles go through the various stages of development in the conserved ovary or ovaries after the uterus has been removed, it is not at all certain that the function of the internal secretion continues uninfluenced by the great changes in the blood supply, and by the traumatism to which the pelvic sympathetic nerves are subjected as a consequence of the operation. It is still a disputed point as to what degree the climacteric syndrome is due to the removal of the ovaries, and to what degree it is due to injury to the pelvic nerves incident to the operation. Clinically, it has been found that the freedom from the climacteric syndrome in hysterectomized women in whom the ovaries have been conserved, is only relative to that which obtains in the same class of women in whom the ovaries have been removed; a generous estimate would be 20 per cent. in favor of the former. To obtain the benefits claimed by the advocates of conservatism, the ovaries should be retained at all ages and not limited to the cases under forty-five years of age as is the custom with most operators, inasmuch as it has been shown that of the women who suffered most severely from the artificial menopause, 23 per cent. were over forty-five years old. Subsequent disease of the conserved ovary, such as cystic degeneration, malignant growth, inflammatory processes leading to adhesions, and pain calling for a second operation, does occur in some cases, the actual number no doubt being much larger than would be inferred from the records found in the literature. In view of the foregoing conclusions, Vineberg is of the opinion that the doubtful clinical advantages accruing from retaining the ovaries in hysterectomy are more than counterbalanced by the risks

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1913, p. 253; June, 1914, p. 247.

<sup>2</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 559.

to which the patient is subjected from subsequent disease and adhesions of the conserved ovaries. Therefore, he would not retain the ovaries in any case of hysterectomy, unless he could leave enough of the lower segment of the uterus with its endometrium to ensure the function of menstruation (Zweifel's method). For, in his experience, the knowledge imparted to the woman that her ovaries have not been removed has little significance or moral effect when she learns that she will no longer menstruate.

**The Complications of Ovarian Tumors.** A most thorough study has been made by Wiener<sup>1</sup> upon a series of 240 consecutive operations for ovarian tumors performed at the Mt. Sinai Hospital in New York. The series includes parovarian, as well as ovarian, tumors, and in 29 cases there were bilateral tumors, making 269 tumors in all, classified as follows:

Simple serous cystadenoma . . . . .	110
Dermoid cyst . . . . .	60
Papillary serous cystadenoma . . . . .	27
Pseudomucinous cystadenoma (17 simple, 1 papillary) . . . . .	18
Parovarian (8 simple serous, 2 papillary) . . . . .	10
Corpus luteum cyst . . . . .	4
Fibroma . . . . .	3
Fibromyoma . . . . .	1
Teratoma (1 solid, 4 cystic) . . . . .	5
Sarcoma (3 large round celled, 1 fibrosarcoma) . . . . .	4
Carcinoma . . . . .	24
Unclassified . . . . .	3

**TORSION.** This is by far the most frequent complication, being encountered 33 times, or 12.26 per cent. Among the numerous causes which have been assigned are trauma, such as a sudden jolt or fall, sudden changes of posture, manipulation during examination, intestinal peristalsis, pressure from a gravid uterus and uterine contractions, but by far the most ingenious contribution to the subject of the cause of torsion is that made by Jolly,<sup>2</sup> who believes that the cause of the twist is due to the tumor itself by means of its expansive force. The tumor, in growing, eventually presses upon the pelvis or abdominal wall where it meets with firm counterpressure. In order for a twisting motion to take place, there must be an unequal tumor mass on either side of the pedicle, so that the pedicle acts as a fulcrum and the tumor mass acts as a one-armed lever upon this point of leverage. As the tumor grows, the counterpressure from the abdominal wall or pelvis must cause a rotary motion upon this point of leverage and the tumor, when turned to a sufficient degree, will fall over by its own weight. The changes induced in a tumor by a twist of its pedicle depend less

<sup>1</sup> American Journal of Obstetrics, 1915, lxxii, 209.

<sup>2</sup> Ztschr. f. Geburtsh. u. Gynäk., 1907, lx, 87.

upon the degree of torsion than on the condition of its blood supply; the minor changes are by far the more frequent, such as hemorrhage into the cyst cavity, hemorrhage into the wall of the cyst and loss of surface epithelium with the formation of adhesions. Microscopic necrosis is fairly common in the severer cases, and actual gangrene was encountered in 3 of the cases, in all of which the vessels in the pedicle were thrombosed; 5 of the cases had free fluid in the peritoneal cavity, but in none of the cases was there a severe peritonitis. In a typical case, the occurrence of sudden severe pain, with nausea and vomiting, increased pulse rate, a rise in temperature and palpation of the tumor mass distinct from the uterus will confirm the diagnosis. Nausea and vomiting are very characteristic symptoms, and occurred in 50 per cent. of the cases, but sudden attacks of severe abdominal pain are the most characteristic of all. These may be repeated at intervals of weeks or months, and were present in every case in which the tumor showed serious lesions as the result of interference with its blood supply. Uterine hemorrhage is the exception rather than the rule; 5 cases had menorrhagia and 1 had metrorrhagia; in the remainder of the cases the menses were normal in type. Well-marked rigidity of the abdominal wall was exceptional, being present in only 4 cases.

**RUPTURE.** There were 5 cases of rupture of the cyst wall in the series, and, although injury is frequently called upon to account for the rupture, it should be looked upon as a secondary cause, the primary cause being a weakening of the connective tissue of the cyst wall. This may be due to increased intracystic pressure caused by a rapid increase in the cyst contents, as in torsion or suppuration, or by pressure of other tumors from without, such as a fibroid or a pregnant uterus, or, again, it may be due to destruction of the connective-tissue capsule through penetration by the epithelial elements of the cyst, which process is typically seen in papillary growths. At the moment of rupture, there may be absolutely no symptoms, or, on the other hand, there may be such extreme pain as to cause the patient to faint. The symptoms subsequent to rupture will depend upon the character of the cyst contents evacuated into the peritoneal cavity and the susceptibility of the individual peritoneum thereto, and will vary from a mild peritoneal irritation to the most intense peritonitis. When no examination has been made previous to the time of rupture and the patient herself has been unaware of the presence of the tumor, it will be practically impossible to make an absolute differential diagnosis between a number of acute intra-abdominal conditions.

**INFECTION.** There were 6 cases of infected cysts in this series (2.23 per cent.) and the organisms were streptococcus in 1, mixed streptococcus pyogenes and staphylococcus albus in 1, typhoid in 1, 1 case showed no growth, and in 2 cases the organisms were unidentified. Infection of a cyst may occur by direct extension through the cyst wall from the

surrounding organs, by the blood or by the lymphatics. The symptomatology of infected cysts is very variable, but, in addition to the symptoms of cyst, fever is almost invariably present. If the infective process passes the restraining barrier of the cyst capsule, peritonitis, with all its signs and symptoms, is added to the picture. Pain is more marked and more persistent than in non-infected tumors, and there is usually marked tenderness of the tumor. Generally speaking, increase of pulse rate, elevation of temperature, and an increased leukocyte count will be more marked than with any other complication of ovarian tumors.

**MALIGNANT DEGENERATION.** It is necessary to sharply differentiate between malignant degeneration of a histologically benign growth and primary malignancy; metastases of malignant growths in benign tumors must also be excluded. In this series there were 5 cases of malignant degeneration of benign growths, 3 cases of squamous-cell carcinoma developing in dermoid cysts, 1 papillary adenocarcinoma in a serous cystadenoma and 1 adenocarcinoma in a pseudomucinous cystadenoma.

PREGNANCY complicated the ovarian tumor in 11 cases, but in only 2 of these was the operative interference followed by sufficiently strong uterine contractions to discharge the products of conception; in the remaining 9 cases the pregnancy continued to term. Of special interest are 2 cases, in 1 of which the only corpus luteum present was removed, and in the other the sole remaining ovary was removed, yet neither resulted in abortion. These cases go far toward disproving the theory that the corpus luteum or even the ovary is essential for the development of the ovum, once it has found its nidation in the uterus.

ASCITES, including under this term only the cases in which considerable transudate was present in the peritoneal cavity, was found in 21 cases in the series; 11 times (mostly blood-tinged) with carcinoma, 1 with an uncomplicated cystadenoma of the papillary type, 5 times with tumors with twisted pedicles, 3 times with simple uncomplicated fibromata and 1 with an infected dermoid.

MISCELLANEOUS COMPLICATIONS included such conditions as *uterine fibroids* (4 cases), *chronic metritis* (3 cases), *retroflexio uteri* (2 cases), *hydrosalpinx* (5 cases), *chronic gonorrhreal salpingitis* (4 cases), *pyosalpinx* (2 cases), *incomplete abortion* (1 case) and *ectopic gestation* (2 cases). In general, it may be stated that with acute pelvic conditions complicating ovarian tumors, the predominating symptoms will be those of the acute condition, while the more noticeable physical signs will be those of the tumor and they are apt to obscure all else and dominate the picture.

**DEATHS.** There were three deaths in this series referring only to the immediate postoperative mortality and not to the subsequent fate of the patients after leaving the hospital. Doubtless a considerable number of the cases of malignant disease succumbed within a few

months of their return to their homes. Of the three postoperative deaths, two occurred in cases of carcinoma, the other was in a case of pseudomucinous cystadenoma which was infected and was operated upon seventeen days postpartum. The total mortality therefore was 1.25 per cent., or, excluding the deaths of the two advanced cancer cases, the mortality was 0.41 per cent. The mortality of the uncomplicated cases was *nil*.

**Symptomatology of Corpus Luteum Cysts.** Halban<sup>1</sup> has observed that the formation of a corpus luteum cyst in the ovary has a definite effect on the menstruation, causing a delay in the appearance of the menses. In many cases the patients will state that they have menstruated regularly but the last period has been delayed several days and examination at this time will reveal a slightly enlarged uterus and a mass of small size in the region of one of the adnexa. The case will strongly suggest an ectopic pregnancy, but must be carefully differentiated, because a corpus luteum cyst does not call for an immediate operation, as it often recedes or gives no further trouble, while an ectopic pregnancy, of course, should be operated upon at once. This observation of the association of a corpus luteum cyst and amenorrhea is not a mere coincidence, since Halban has shown that the simple extirpation of a corpus luteum can cause the menses to suddenly appear, while if the extirpated corpus luteum is transplanted into the abdominal cavity, the menses will not appear even though it is the normal time for menstruation. In a corpus luteum cyst, the lutein tissue remains active longer than in a simple corpus luteum, and hence the effect on menstruation is of longer duration, but, after the lutein tissue in the cyst has been absorbed or removed surgically, the menstruation again becomes normal. Halban mentions several cases which he has seen in practice in which the patients have had amenorrhea for from a few days to several months associated with an adnexal tumor, in which the menses returned a few days after the removal of the tumor, which proved to be a corpus luteum cyst. The walls of these cysts are easily ruptured, and often a cyst is ruptured during a bimanual examination, allowing the lutein tissue to be resorbed, and, as a consequence, the menses reappear shortly afterward.

**Ovarian Fibroids.** As evidence of the rarity of fibroid tumors of the ovary, Hellman<sup>2</sup> states that of 4500 pathological specimens that have been preserved and examined microscopically in the Frauenklinik in the Königliche Charité since April, 1904, only 6 cases of ovarian fibroid could be found after a careful search. The age at which this condition can arise is probably any time after the onset of the menses, the largest tumor coming from a patient seventeen years old, but most cases occur around the time of the menopause or later. The interesting etiological factor is to determine from what tissue of the ovary these

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 24, 409.

<sup>2</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 692.

tumors arise, but this question could not be decided absolutely. The symptoms are notably few, the most common being a swelling in the abdomen of slow onset. There may be sharp pain over the tumor due to local peritonitis, or there may be referred pains due to nerve pressure, together with other pressure symptoms, such as interference with the function of the bladder and bowel. There is often a loss in weight, but uterine bleeding is of rare occurrence. There are merely the signs of an adnexal tumor on examination, but no other signs which would aid in the determination of the variety of the tumor.

The method of treatment can be stated in one word, namely, operation. The prognosis is good and if the pathological report is trustworthy *fibroid* or *fibromyoma*, and not sarcoma, the case will need no further watching. These tumors vary from the size of a cherry pit to tumors weighing 40 kg. but in the end the diagnosis must always rest on the microscopical findings. There must be a certain regularity of the individual fibrous or muscular cells and strands despite varying quantities of cells, fibers, vessels, and degenerative changes. The fibrous cells are, as a rule, short and spindle-shaped, and the protoplasm surrounds the nucleus only very slightly. The nucleus is bent or pointed, and edema is extremely common and very variable in degree, sometimes scarcely noticeable and at other times so extensive as to cause large areas to exist almost free from cells. If any epithelial elements are present, one must classify the tumor elsewhere. Fibroma is distinguished from sarcoma in its regularity and in the shape of the cells. Sarcoma cells are rich in protoplasm, have various shaped nuclei, mostly oval and containing a greater or less number of mitotic figures. Marriage, menstrual history and leucorrhea do not play a very important part in the history of these cases.

**Bilateral Sarcoma of the Ovaries.** Bilateral ovarian sarcoma in a child under sixteen years of age is exceedingly rare, indeed up to the past year there had been only one case reported, and that was in a fetus. Smith and Motley,<sup>1</sup> however, during the past year, reported a case of bilateral sarcoma of the ovaries in a girl of three years, that is the only case that has ever been operated upon, so far as their search of the literature was able to determine.

**Pregnancy after Conservative Ovariectomy.** In order to plea for conservatism in the performance of ovarian surgery, Freund<sup>2</sup> relates the case of a woman, twenty-two years of age, who had a hydatidiform mole removed in September, 1913, and at that time bilateral ovarian tumors about the size of a fist were found. The left ovary was polycystic and was removed *in toto*. On the right side, the cyst was brought up into the wound, the hilus incised and the serosanguineous fluid removed. In the wall of the cyst was noticed a small bit of ovarian tissue with

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 419.

<sup>2</sup> Zentralbl. f. Gynäk., 1915, 30, 523.

normal follicles, which was separated with a pair of scissors and sutured to the cyst pedicle. The tumor, which was a pseudomucinous cystoma, was removed in the normal manner and recovery was uneventful. The patient became pregnant ten months after the operation and in May, 1915, gave birth to a healthy baby without artificial aid and was out of bed in nine days. Such cases as this should not pass unnoticed, since we are all too prone to remove the ovaries in such cases without even stopping to consider whether or not there is a possibility of saving at least a small bit of ovarian tissue.

**Pelvic Varicocele.** The chief symptom complained of by many women seeking advice for the so-called female troubles is a persistent, dull aching pain in the left iliac region, at times barely noticeable, at other times very severe. In many instances this pain is relieved by the recumbent position, and aggravated by standing or walking and is usually worse at or during the menstrual period. This symptom is frequently unassociated with palpable intrapelvic lesions, except perhaps a slightly enlarged ovary or a retrodisplaced uterus, although in the parous woman there may be tears of the cervix or pelvic floor. Women who have uterine displacements or lacerations undergo the usual operations for these conditions and many times are ultimately relieved, but some are certainly no better. Women presenting no palpable lesion except slightly enlarged ovaries, are often told that they have chronic ovaritis, or that there is absolutely nothing wrong with them and the pains are due to their neurotic condition. In cases of this type, Pinkham<sup>1</sup> believes that the veins of the pampiniform plexus are most commonly affected, on account of their location, poor structural support and lack of valves, and he would include all these cases under the term "pelvic varicocele."

The frequency of this condition on the left side, as is well known, is due to the fact that on this side, the ovarian vein, the principal drainage canal of the outer part of the broad ligament, after leaving the infundibulopelvic ligament, runs inward and upward behind the mesentery of the sigmoid and descending colon to the renal vein, which it enters at right angles. It has at best only two valves, one at its exit from the plexus and one as it enters the renal vein, and sometimes one or both valves are missing. It is easily seen, therefore, that interference from above with the free passage of blood, or the lack of propulsive power from below, must tend to produce venous engorgement. This interference and lack of power have much less force on the right side, because here the ovarian vein runs from the infundibulopelvic ligament at an acute angle to the inferior vena cava only a short distance away. The child-bearing woman is the most frequent sufferer from this condition, because, during pregnancy, the return flow of

<sup>1</sup> American Journal of Obstetrics, 1915, lxxii, 244.

blood from the pelvis may be interfered with by the weight of the uterus, tight clothing, constipation, etc. In Pinkham's experience, the most frequent causes, especially in the young woman or nullipara, are a sigmoid adherent to the outer third of the broad ligament and constipation consisting of either a complete failure to empty the bowel at proper intervals, or only partial evacuation. There is no doubt that many women could be relieved of their left-sided pains if the simple operation of ligation of the varicocele were more frequently performed. It might be said that the combination of a dull, persistent aching pain, as described above, is fairly good evidence of the existence of a varicocele, provided that there are no gross lesions present. Medical treatment of this condition is only palliative; the use of tampons or pessaries, or rest in bed with the foot slightly elevated, sometimes gives relief for the time being. As in varicocele in the male, the only permanent cure is attained by surgical means. The abdomen should be opened, the varicosities doubly ligated and either excised, or simply divided. Double ligation alone is efficacious, but there is the chance of reestablishment of continuity, which is absolutely prevented by excision or division. In order to substantiate his argument, Pinkham reports a half dozen cases of this type which he has successfully operated upon.

### THE VAGINA AND VULVA.

**Carcinoma of the Vagina Associated with Prolapse.** We frequently see in prolapse of the vagina, the formation of those interesting forms of ulceration which the Germans have called *decubitus* ulcers, which are probably due to the constant irritation to which the vaginal wall is subjected when it appears outside of the body. One would naturally think that such ulcerations would be very prone to undergo malignant change, especially if any credence is to be placed in the irritation theory of cancer, but, as a matter of fact, quite the reverse conditions obtain. Carcinomatous change occurring in a decubitus ulcer is very rare, and, personally, I have never seen such a case, while carcinoma occurring in a prolapsed vagina, irrespective of any preexisting ulceration, is also a very rare condition, there being only 10 cases of such a character in the literature. One more case has recently been added by Loser.<sup>1</sup> In simple cases of carcinoma of the vagina, the growth is situated on the posterior wall in 70 per cent. of the cases, while in cases of carcinoma associated with prolapse, the neoplasm is always situated laterally. The prognosis in these cases is very bad, but Loser reports two such cases that have gone eighteen and twenty-two months respectively since operation without recurrence.

<sup>1</sup> Abstract in Zentralbl. f. Gynäk., 1915, 5, 79.

**Fibromyomata of the Vaginal Wall.** Notwithstanding the fact that the vagina is the seat of numerous insults, bacterial and otherwise, and in spite of the fact that its musculature is closely allied to and undergoes the same development as the uterine muscle, the vagina is seldom the seat of fibromuscular tumors as compared with the frequency with which these tumors are met in the uterus. Although there have been nearly 200 such cases reported, the etiology still remains obscure. The fact that these tumors are most frequently found in the median line of the anterior and posterior vaginal walls would support the view that they arise from embryonal remains or cell rests. Kleinwächter, in 1882, reported 53 cases, and Müller, up to 1905, collected 112 other cases.

Giesecke<sup>1</sup> has reviewed the literature since 1905 and gives a brief résumé of each case, adding one of his own and bringing the total number of reported cases up to 195. The history of his case is that of a previously well woman, fifty-six years old, whose menses were always regular and normal. She had one child in 1884, which was a spontaneous delivery and the puerperium was normal. She never had an abortion and her menopause had occurred normally six years before admission. Since her labor she has had symptoms of prolapse and was treated by means of a pessary, which had relieved her somewhat. Her bowel function was normal, but she had some urinary frequency, having to urinate two or three times at night. She also began to have some leucorrhea but had no disturbances in intercourse. On account of a feeling of "pressure underneath," the patient came to the hospital in order to get operative treatment for what she considered a prolapse, and upon examination, the findings were extremely suggestive of a descensus or prolapse. By pressing on the anterior vaginal wall, there was felt a mass about the size of an apple which was ovoid, irregular, and of thick consistency, which argued against the mass being a cystocele. The uterus was small and retroverted, and the cervix presented a small polyp, the adnexæ were normal. The mucous membrane of the vagina was adherent to the tumor, but there was no ulceration. The mass was diagnosed as a fibromyoma of the vaginal wall, and was removed under ether anesthesia. It was found well encapsulated and resting lightly against the base of the bladder and urethra. The microscopic examination of the tumor substantiated the clinical diagnosis. Giesecke states that these tumors occur in the anterior vaginal wall in 80 per cent. of the cases, and in the posterior wall in 13 per cent. Of the various complications to which these tumors are liable, perhaps the most interesting is a case reported by Halban in which the tumor pressed against the right ureter and caused a right hydronephrosis.

**Carcinoma of Bartholin's Gland.** Carcinoma of the vulva is the most infrequent form of carcinoma of the female generative apparatus, and,

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 6, 81.

when present, it is found mostly affecting the clitoris, next in frequency is the orifice of the urethra and rarely it is found in the region of Bartholin's gland. Wittkopf<sup>1</sup> has seen 2 cases of carcinoma of Bartholin's glands in a short time at the Frauenklinik in Kiel, both of which affected the gland on the left side and both were of the squamous-cell type. The treatment of these cases consisted of extirpation of the tumor together with the inguinal glands on both sides, and then placing radium in the tumor bed; the results thus far have been satisfactory, although the time since operation has been too short to speak of recurrences. Carcinoma in this location is of very slow development and there are practically no subjective symptoms in the beginning, hence the cases come to the surgeon very late in the course of the disease. If the epithelial covering of the gland is intact, the diagnosis must be made between some benign tumor and carcinoma; if the carcinoma is broken down, but the wall is still unruptured, there may be a question as to whether it is carcinoma or a simple abscess, and there have been cases which were incised on the assumption that they were simple abscesses. The German literature contains only 12 cases of carcinoma of Bartholin's gland, the ages of these patients being under thirty in 1 case (following chronic gonorrhea), between forty and fifty in 4 cases, between fifty and sixty in 6 cases and over seventy in 1 case. In over half of the cases, the growth was diagnosed as a squamous-celled carcinoma, but, as a rule, it is not possible to state definitely from what structures the carcinoma originated.

**Sarcoma of the Vulva.** This variety of neoplasm is also very rarely found in the vulva, but when found there it is very malignant and prone to recur after operative removal, in some cases many years afterward, as in a case reported by Rhomberg.<sup>2</sup> In this case a sarcoma was removed from the right labium in 1908, the wound healing by first intention and the condition giving no further trouble until 1914, when the patient returned to the hospital with another growth in the same location, stating that it had been slowly getting larger during the preceding year, but she had been subject to no discomfort, locally or constitutionally, due to its presence. The microscopic examination of this growth revealed it to be a spindle-celled sarcoma.

**Sweat Gland Tumors of the Vulva.** In 1904, Pick, of Berlin, reported 2 cases of vulvar tumors which he considered arising from the sweat glands, because of their adenomatous structure lined in many places by a double layer of cells, and in places the superficial epithelium covering the labium seemed to send down prolongations which communicated with the tumor acini. Since this report of Pick, there have been several other similar cases reported, the latest of which is that presented by Outerbridge.<sup>3</sup> In this case, the tumor is about 1 cm. in diameter, lies almost entirely within the thickened corium of the skin, reaching

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 22, 369.

<sup>2</sup> Ibid., 45, 780.

<sup>3</sup> American Journal of Obstetrics, 1915, lxxii, 32.

slightly into the subcutaneous tissue in its deepest portion. It consists primarily of innumerable irregular acini and papillæ, the acinar characteristic being more marked in the peripheral portions, the papillary in the centre. The individual acini are separated by exceedingly delicate connective-tissue septa, though in places these are somewhat thicker and carry small bloodvessels. Under the high power, many of the acini are seen to have a distinctly double layer of epithelium, consisting of an inner row of sharply defined, tall, columnar cells with central nuclei,



FIG. 109.—Medium power photograph of a portion of the periphery of the tumor showing adenomatous character. At the right is the surrounding fibrous tissue of the corium. (Outerbridge.)

and an outer row of somewhat less distinct, irregularly oval or cuboidal cells, but in other areas the double layered character of the epithelium is not so apparent, merely the tall columnar cells being distinguishable. In suitably stained specimens, a very rich network of elastic fibers can be seen running in the connective-tissue septa between the individual acini throughout all portions of the tumor. The structure of this growth corresponds very closely with those described by Pick, except that no definite communication with the epidermis can be demonstrated. Outerbridge is convinced that this tumor is entirely benign, since the

structure is regular throughout, there is no tendency for the epithelial elements to break through the basement membrane, nor to become heaped up into multiple layers. This case is the twelfth one that has been reported.

**Tuberculosis of the Vulva.** Considering the fact that tuberculosis of the genitals is found in about 2 per cent. of cases coming to autopsy, showing other lesions of tuberculosis, and recalling the fact that, of 663 cases of genital tuberculosis that have been reported by nine investigators, there was not one case of tuberculosis of the vulva, we must concede that this condition is quite rare, indeed only 71 cases have been reported since 1881. This subject has received extensive consideration at the hands of Bulkley,<sup>1</sup> who states that 17 per cent. of the cases occur before the tenth year of life. As sexual life develops, the involvement of the vulva increases to such an extent that between the ages of twenty and forty, one-third of the cases are found, but after the age of fifty-five, the disease is rarely seen. The local causes which may cause a *locus minoris resistentiae* are grouped by different authors under trauma on the one hand and inflammatory changes on the other.

**CLASSIFICATION.** The disease has been subdivided into three groups for the purposes of study but for all practical purposes, the two latter classes can be grouped together as secondary tuberculosis.

1. Primary vulvar tuberculosis, in which there is not any other tuberculous focus in the body.

2. Primary vulvar tuberculosis by auto-inoculation, in which the individual is already the subject of some tuberculosis and infects her vulva herself, by her fingers or sputum.

3. Secondary vulvar tuberculosis, in which the individual already has tuberculosis somewhere in the body and the vulva becomes infected through the body juices.

*Primary vulvar tuberculosis* is the least common type, and is found in from 20 to 25 per cent. of the cases. Among the modes of infection suggested are coitus, masturbation, clothing, pessaries, douche nozzles, wash cloths, baths and toilets, the presence of the tubercle bacillus in wash water and air infection. In the majority of cases, however, infection probably occurs either through coitus or sputum, since it has been shown by several men that a tuberculous individual without genital lesions could transmit the bacillus by coitus.

*Secondary vulvar tuberculosis* can occur from the transmission of the bacillus either without or within the body. In the first class belongs the group in which the vulva is infected by discharges and secretions containing the tubercle bacillus which are brought in contact with the vulva externally. In the second class there are four possible routes of infection. The *hematogenous* route is almost purely theoretical, the evidence in favor of this method of infection being very scanty; the

<sup>1</sup> American Journal of Medical Sciences, 1915, exlix, 535.

same may be said of the *lymphatic* route which is difficult to differentiate from extension by contiguity of tissue. Perhaps the most common method of extension is by *contiguity of tissue*, in which the vulva becomes infected from a tuberculous vaginal ulcer or rectal inflammation. The fourth route of infection in this class is by *continuity of surface*, in which the infection is derived from tubercle bacilli in the discharges either from the urinary system, genital system above the vulva or from the feces in cases of tuberculous enteritis. This mode of infection is not common but does occur occasionally.

**SYMPTOMATOLOGY.** The general symptoms are relatively slight and depend on the amount of tuberculous involvement of the rest of the body, since in primary vulvar tuberculosis, the general symptoms are negligible and the local symptoms are slight until the lesion is well advanced. There may be burning, smarting, pruritus or vulvar enlargement, and, if there is ulceration, especially if it involves the vagina, there will be leucorrhea and perhaps burning on urination due to the urine passing over the raw area. Pain is not marked except possibly during coitus. The local physical signs are of five types:

1. *Hypertrophy with ulceration* is the most common type, the hypertrophy being due either to edema or hyperplasia, possibly starting as the former and continuing over a long period of time, it becomes transformed into the latter. The ulceration may vary in extent from minute pin-head areas to areas so large that the entire vulva, perineum and anal region may be transformed into a veritable cloaca.

2. *Hypertrophy without ulceration*, a very rare form, the hypertrophy being due to hyperplasia and not to edema.

3. *Ulceration without hypertrophy* is more common in children than in adults, and is recognized by the typical tuberculous ulceration.

4. *Lupus type*, in which lupus vulgaris attacks the vulva. In appearance, it is much the same as lupus in any other region except that ulceration occurs more frequently and earlier, due to the constant presence of moisture.

5. *Fistulas and abscesses* occur in cases where a tuberculous focus in the vicinity breaks down or points into the vulva.

The relative frequency of involvement of different parts of the vulva by the tuberculous process in a series of 103 lesions, on which this report was based, was as follows:

"Vulva"	10 cases
Labia majora	29 "
Labia minora	30 "
Clitoris	8 "
Entire introitus	7 "
Posterior commissure	6 "
Anterior commissure	3 "
Mons veneris	2 "
Edge of urethra	5 "
Bartholin's gland	2 "
Prepuce	1 "

The condition is more frequently unilateral than bilateral, and involvement of the labia majora and minora is the most frequent association.

**DIFFERENTIAL DIAGNOSIS.** Tuberculosis of the vulva may have to be differentiated from gonorrhoeal vulvovaginitis, anogenital diphtheria, gangrene, acute Bartholinitis, phagedenic ulceration, syphilis in its various forms, chancroid, epithelioma, sarcoma and kraurosis vulvae. The prognosis is not good since probably over 50 per cent. die from the disease or the associated tuberculous foci elsewhere in the body.

**THE TREATMENT** must consist of radical measures combined with hygiene, and, if the disease is fairly well localized, with tuberculin. Radical measures include curettage, cauterization by heat, excision of the lesion by the thermocautery and dissection excision. Curettage is

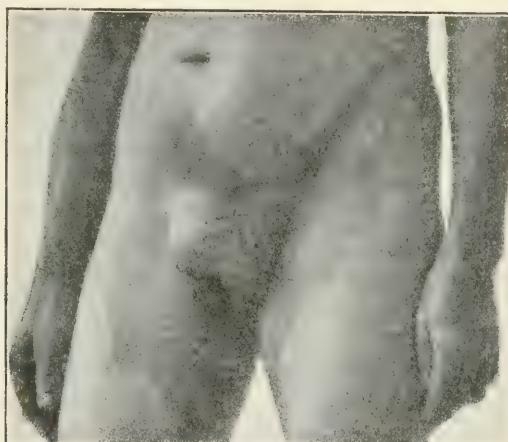


FIG. 110

mentioned only to condemn it, as it is more apt to spread than to cure the lesion and it should never be used. Excision by means of the cautery knife is the method of choice, as the diseased tissue is removed, the lymphatics are sealed and there is not much destruction of the surrounding healthy parts. Local dusting powders and chemical cauterization are worthless. If the inguinal glands are evidently infected, they should be removed. In concluding his report, Bulkley reports 1 case of his own, bringing the total number of reported cases up to 72.

**Subcutaneous Rupture of the Clitoris.** From Küttner's clinic comes the report of a rather unusual and interesting case, which has been reported by Melchior.<sup>1</sup> The patient, a woman, aged fifty-seven years, had had a left inguinal hernia for many years, but it had never troubled her in any way. Three weeks prior to her admission to the hospital,

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 7, 97.

she stumbled while walking on the street and struck the front part of her pelvis on a stone, as a result of which she developed a swelling at that site. The physician who saw her considered the case one of strangulated hernia and tried to reduce it but was unsuccessful, so that the patient came to the hospital for operative treatment. Upon examination, there was a swelling above and to the right of the symphysis pubis, about the size of a fist, covered with intact skin, smooth surface, egg-shaped, giving a sensation of fluctuation, and more or less continuous with the labia majora behind. There seemed to be no connection with the inguinal hernia, vulva or vagina and the mass was slightly movable over the underlying structures, did not pulsate nor increase in size when the patient strained or coughed. The skin on the inner side of the right thigh near the groin showed considerable greenish-blue discoloration. A diagnosis of incarcerated hernia was made although there were no symptoms of intestinal disturbance. At operation, a well-encapsulated, bloody cyst was found, which, upon examination, was found to be connected with a rupture in the corpus spongiosum of the clitoris under the symphysis pubis, and the manipulations necessary to free the cyst in this location caused considerable bleeding. Pathological examination of the extirpated cyst proved it to be a well encapsulated hematoma, which Melchior is sure resulted from the rupture in the clitoris as a result of trauma.

**Vulvovaginitis in Children.** The frequency with which gonococcal vulvovaginitis is seen in the young, the difficulty often experienced in demonstrating the specific microorganism and the extreme chronicity of this form of infection are known to most workers in this field of medicine. Vulvovaginitis may be due to various organisms, but, in the large majority of cases occurring among children, the gonococcus is the exciting factor, being considered the cause in over 80 per cent. of the cases by those of large experience.

Norris<sup>1</sup> pleads for more regularity and thoroughness in the treatment of these cases, and emphasizes the importance of determining whether a cure has been established before allowing the treatments to cease. In recent years, the complement fixation and cutaneous tests have proved of great value in the diagnosis of gonorrhea, but, unfortunately, in the case of vulvovaginitis, the negative results obtained by these tests cannot be accepted as giving a free bill of health to the child. On the other hand, positive results are to be regarded as diagnostic in practically all cases in which the tests have been carried out by an experienced bacteriologist. Therefore, these tests are of secondary importance in determining when a cure has been effected, and, in order to decide this question, we are still compelled to rely on the bacteriologic examination. In order to determine the presence of the gonococcus in the genital

<sup>1</sup> Journal of American Medical Association, 1915, lxv, 327.

tract, Norris has been following the technic which has been outlined by Van Gieson with very satisfactory results. The child is placed in the Sims left lateral position, the external genitalia are exposed and wiped with a cotton sponge wet with mercuric chlorid solution and then separated. Any discharge that is present is removed by means of a dull knife blade, since the cotton swab which is usually employed for this purpose is of lessened value, because it tends to retain within its meshes the cellular elements of the discharge, which are the most important. Furthermore, the act of rubbing the swab over a glass slide has a tendency to destroy the pus cells, so that when the smear is examined, more extracellular organisms will be found to be present. If this smear is negative or otherwise unsatisfactory, the patient is placed in an elevated position so that the solution will not run out of the vagina and with a soft rubber syringe, about one-half ounce of 1 to 5000 mercuric chlorid in normal salt solution is injected. A small glass rod is introduced and rubbed against the vaginal walls for the purpose of detaching any adherent secretion and then the solution is vigorously forced in and out of the vagina a number of times by means of the syringe. The solution thus obtained is centrifuged for fifteen or twenty minutes at high speed, and the sediment examined in the usual way. In suspected cases that yield negative findings by the means just described, or as a final measure before discharging the patient as cured, the following method is recommended:

On the day prior to the bacteriological examination, the entire vagina is painted with a moderately strong solution of silver nitrate, the strength of the solution varying somewhat with the age of the patient and the condition of the vaginal mucosa. Usually a 5 or 10 per cent. solution is sufficiently strong to produce a distinct reaction. On the following day washings from the vagina are obtained, and these will often show gonococci that have been undemonstrable by other methods. In 21 chronic cases in which the method just described was used, the following results were obtained, demonstrating the value of the method: Simple smear, positive, 45 per cent.; washings, 75 per cent.; washings preceded by chemical irritation, 97 per cent.

**TREATMENT.** The treatment of gonococcal vulvovaginitis, as outlined by Norris, is based on the facts that desiccation quickly destroys the gonococcus, and that the organism does not thrive on squamous epithelium except that of the immature variety. The patient is placed in the knee-chest or Sims position in order to thoroughly expose the vaginal walls, and, in most cases, the hymen is sacrificed as soon as the diagnosis is positively made, in order to obtain better drainage and more thorough treatment. The vagina is thoroughly washed with a weak solution of potassium permanganate and then swabbed with a 25 per cent. argyrol solution, merely as a cleansing agent. The vagina is then dried as thoroughly as possible by means of thin strips of gauze

followed by a stream of air from an empty atomizer. The child is then allowed to remain in the Sims position for from twenty to thirty minutes, care being observed during this time to keep the vagina well distended with air. When this has been done, the vagina should be thoroughly dry and then, as a final step, with the vagina thoroughly distended, it is flooded with a weak solution of silver nitrate. At first, about a 1 or 2 per cent. solution is employed, but as the vaginal mucosa becomes more fully developed, stronger solutions may be utilized. The treatment here described is applied three times a week, and during the interim the vagina should be washed out daily by the mother or nurse with either a weak potassium permanganate or argyrol solution, a soft rubber eye-syringe being employed. It is safe to consider that a cure has been effected when negative findings have been obtained after three consecutive bacteriological and physical examinations, at two-week intervals, during which time no treatment has been employed, the last examination being preceded by the chemical irritation with silver nitrate as previously described. In 14 cases in which Norris has applied this treatment, a cure was established in an average period of twelve weeks, the cure being regarded as dating from the day of the first of the three consecutive negative examinations.

#### MENSTRUATION.

**New Theory of Menstruation.** According to Tuffier,<sup>1</sup> every month the female creates a chemical substance by means of internal secretion. When this substance exists in the blood in sufficient quantity, it acts on the ovary, which modifies it, and menstruation is consequently produced by this modified internal secretion and the secretion itself is eliminated with the flow. He has localized this substance in the blood serum, and can produce menstruation by injecting defibrinated blood. If menstruation does not occur, then the chemical substance is retained in the circulation and causes an auto-intoxication which we call the troubles of the surgical change of life. The blood of a woman immediately before menstruation contains this chemical substance, which is proved by the fact that if blood be taken from a woman who is about to menstruate and then injected into a patient who is between two periods, or whose period is delayed, this injection immediately causes the menstrual flow to appear. In proof of this, Tuffier offers the two following interesting cases:

Case 1. A woman, aged thirty-two years, had not menstruated for two years after her last confinement. After the injection of 24 c.c. of serum taken from another patient on the day before menstruation, the patient's menstrual period returned and has been regular for three months.

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 34.

Case 2. A woman, aged forty-eight years, was at the beginning of the natural change of life and was suffering from natural nervous disorders which occur at this time. Thirty c.c. of defibrinated blood taken from a woman twenty-four hours before her menstrual period was injected. Four days after the injection, menstruation came on and all the symptoms of the change of life disappeared.

**The Relation of the Reaction in the Endometrium to the Character of Menstruation.** It will be recalled that Hitschmann and Adler<sup>1</sup> were able to demonstrate quite clearly that the uterine mucosa undergoes a cyclical change which corresponds with the clinical cycle of menstruation. This cycle has been divided by them into four stages, which we shall recall for a few moments:

*The postmenstrual stage*, embracing the few days immediately following menstruation. During menstruation, it seems that the endometrium empties itself so that during the postmenstrual stage, its glands are narrow, collapsed and straight, while the stroma is rather firm and compact.

*The interval stage* is the term applied to the long period between the termination of the preceding stage and the beginning of the premenstrual phase, next to be described. During this period, the endometrium is undergoing a gradual, but steady, development, the glands becoming fuller and exhibiting gradually increasing convolution.

*The premenstrual stage* begins from a few days to a week before the next period. At this time, according to Hitschmann and Adler, there is a sudden increase in the hypertrophic development of the endometrium. The lumina of the glands become much increased, presenting a characteristic scalloping on cross-section, while in longitudinal section they exhibit a dentate appearance.

*The menstrual stage* corresponding to the actual existence of menstruation, is characterized, microscopically, by appearances which are to be looked upon as a transition from those of the premenstrual period to those of the postmenstrual phase. In addition to the vascular phenomena characteristic of this stage, one usually finds that some of the glands are still very hypertrophic while others already show the collapse characteristic of the postmenstrual stage.

A study along the same lines as that of Hitschmann and Adler has been carried on by Novak<sup>2</sup> based upon microscopical examination of the endometrium in 159 cases, in all of which there were satisfactory sections to examine, there was a careful history taken beforehand, and the menstrual periods had always been regular and had recurred at regular intervals. This number of cases (159) represents all the cases out of 2000 records that fulfilled the requirements for the study. As a result of careful study of all of these cases, bearing in mind in each case what

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1914, p. 236.

<sup>2</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 336.

part of the menstrual cycle the patient was in when the endometrium was removed, Novak has come to certain definite conclusions. Speaking generally, the greater the clinical duration and amount of menstrual flow, the greater will be the degree of hypertrophic reaction in the endometrium. An exception to this general law is encountered in cases of anteflexion of what is commonly called the congenital type, *i. e.*, the type so frequently observed in young women and associated with dysmenorrhea, rather scanty menstruation and not infrequently sterility. In this type of case, reaction of the endometrium to the menstrual stimulus is certainly not any less and, if anything, is certainly somewhat more marked than in cases of other forms of pelvic disease.

The condition of congenital anteflexion is commonly looked upon as indicative of greater or less degree of arrest of development of the uterus and in some cases in this series, the uterus was described as of the infantile type. Menstruation was more frequently scanty or moderate than profuse, dysmenorrhea was observed in practically all cases, and in those of the patients who were married, sterility was almost invariable. In spite of the hypoplasia of the uterus in such cases, it was demonstrated that in what may be called the quiescent portion of the menstrual cycle, neither the glands nor the stroma exhibit any demonstrable differences in appearances or development from that observed in the fully developed or even the multiparous uterus at the same period. Furthermore, menstrual hypertrophy of the glands is noted at a comparatively early stage of the menstrual cycle and may proceed to the development of the most marked premenstrual pictures. Such marked hypertrophy does not, in this group of cases, seem to bear any relation to the clinical severity of menstruation, for frequently the periods are described as scanty in amount. Bearing in mind these facts, it is scarcely to be wondered that the present study has led Novak to the conclusion that even in congenital anteflexion or hypoplasia, associated with spadmodic dysmenorrhea, scanty menstruation and perhaps sterility, deficiency of ovarian activity is not a *sine qua non*, but it appears that the endometrium plays a subservient role in menstruation and that, with the exception of one group of cases already mentioned, it is the activity of the ovary that largely determines the clinical character of menstruation and the degree of hypertrophy in the endometrium. This is merely another way of saying that in cases of endometrial hypertrophy associated with profuse menstruation, the latter is the cause rather than the result of the hypertrophic changes in the endometrium.

**The Amount of Endometrium Necessary to Carry on the Menstrual Function** must indeed be very slight according to a report of Frank<sup>1</sup> before the Obstetrical and Gynecological Society in Vienna. He stated

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 16, 263.

that he had in his museum three specimens of carcinoma which had developed in the stump of the uterus after supravaginal hysterectomy. In another case, a woman who had had a supravaginal hysterectomy performed for a myomatous uterus, menstruated regularly every four weeks for three days over a period of three years. Then she began to have almost continuous bleeding from the stump which could not be controlled by röntgenization. Bearing in mind the three cases of carcinoma of the stump which he had already seen, he removed the stump and found that it contained a small myoma at its upper pole. The interesting feature of the case was the fact that there was very little corpus endometrium present, and no section showed more than six or eight glands, and yet this woman menstruated regularly for three years until the stump was removed. The amount of endometrium necessary to carry on menstruation is thus very small and, in operations, where it is desirable for the menses to continue and yet the uterus must be sacrificed, by leaving behind only a very small area of endometrium, there will be a good chance of having the menses continue.

**Cessation of Menstruation after Operations.** The question of when the menses return after various gynecological operations has been studied by various observers and varying reports have been made. Bondi found that there was no influence on the type of menstruation in 63 per cent. of the cases that were curetted. Engländer observed that after simple abortion, in which there was no operative interference, the menses returned in four weeks in 65 per cent., while of the remainder, some returned in five weeks and others later. Schäffer states that the time that the curettage is performed with relation to the period determines the influence that it will have on the period. In the postmenstrual period, curettage causes quite an irregularity in the following periods: in the intermenstruum, there is ordinarily but slight influence on menstruation; in the premenstruum, curettage is apt to postpone the menstrual period.

The latest report on this subject is by Ebeler<sup>1</sup> who gives his experience and observations in a series of 103 cases. There were 13 cases of abortion, all of which occurred in the first three months of pregnancy, in 8 of which the uterus was cleaned out by the digital method, while in the remainder a curette was used. Following this operation, the menses returned in from twenty-seven to thirty days in 5 cases, in from thirty-one to thirty-eight days in 5 cases, and 1 case each on the fifteenth, twenty-third, and fifty-fourth day. In 50 per cent. of the cases there was no influence on the periodicity at all, while in the remainder, although there was some irregularity in the appearance of the first period after operation, the second and third periods appeared at the regular time in nearly every case. In the next group, there were 14

<sup>1</sup> Zentralbl. f. Gynäk., 1915, 8, 113.

cases of hemorrhagic metropathy which were treated by means of the curette, with practically the same results as in the first group. A rather interesting observation was that cases curetted in the postmenstrual and premenstrual phases, especially the latter, are very apt to have some effect on the next menstruation, while those operated upon during the intermenstrual phase, as a rule show no effect on the succeeding period. Therefore, when possible to select the time for curettage, the proper time would be during the intermenstruum. In cases in which the abdomen is opened, if the operation consists of a simple uterine suspension or an appendectomy, there may be slight irregularity in the appearance of the first period, as in the preceding types, but, as a rule, the second and succeeding periods come at the regular time. In 19 cases of adnexal disease which were operated upon the next period was usually delayed slightly and the fact that the patients were operated upon in the postmenstrual, intermenstrual or premenstrual stage seemed to have no influence; in only 4 cases did it appear on time and in only 2 cases was it ahead of time. Ebeler reports 3 cases which continued to menstruate in spite of the fact that both ovaries had been removed. In explanation of this phenomenon, he quotes Frankel who states that unless the ovarian ligaments are removed with the ovaries, the castration is not complete because these ligaments contain some ovarian tissue which hypertrophies after the ovaries are removed. In order to remove all of the tissue with the ligaments, it is necessary either to remove the uterus or else take a small section out of the uterus on each side where the ligaments are attached. Of course, it is possible that another organ can vicariously take on the function of the ovary and thus account for the menstruation in these cases. From the many authors whom Ebeler quotes, the consensus of opinion seems to be that, in from 60 to 80 per cent. of cases, curettage has practically no influence on the menstrual type. His own conclusions are that if an ovary containing a ripe corpus luteum is removed, the next period is delayed or missed and after this the menstrual function is carried on entirely by the other ovary. In cases in which the adnexa are operated upon but not removing the ovaries, the menstrual changes are probably due to interference with the uterine blood supply at the time of operation. In extragenital operations, when the adnexa are not touched, the psychic element may play a part in the menstrual disturbances.

**Intranasal Treatment of Dysmenorrhea.** O'Reilly<sup>1</sup> has revived the discussion on the intranasal method of treating dysmenorrhea in cases in which the usual methods of treatment have failed, irrespective of the type of dysmenorrhea and claims for the method, a relief from pain which is more or less permanent, but which can, of course, be no more than a symptomatic cure at best.

<sup>1</sup> American Journal of Obstetrics, 1915, lxxii, 634.

TECHNIC. The genital spots (tuberculum septi and anterior ends of the inferior turbinates) are thoroughly cocainized by means of a pledget of cotton wet with a 20 per cent. solution of cocaine with adrenalin which is allowed to remain in contact with these spots for three minutes. They are then tested with a probe as to their sensitiveness, and, if sensation is still found to persist, the application is repeated for another three minutes. Then a crystal of trichloroacetic acid fused on the end of a probe is applied to the genital spots in either side of the nose. The slough that forms disappears in about five days, when the same process should be repeated, so that, in all, four applications must be made between the periods. The patient is then requested to report her results at the next menstruation. If the result is favorable, no other treatment is necessary, except that two more reports are requested at the following menstrual epochs, and, if these are favorable, the patient is discharged. In cases in which relief is slight, or not at all favorable, four more applications should be made between the menstrual periods, and if no benefit is reported, the treatment must be put down as negative.

Some of the objections that have been raised against this method of treatment are based on the assumption that the relief from pain which is experienced by these patients is due to cocaine euphoria, and, furthermore, the method is apt to cause the cocaine habit in a certain number of cases. In order to overcome such objections, Block<sup>1</sup> has substituted plain adrenalin for the combined cocaine and adrenalin solution. The application is made in the same way and he claims to obtain as good results in this manner as from the use of cocaine. He is particular, however, to differentiate the types of dysmenorrhea, and states that no result is to be expected from this method of treatment except in cases of ovarian dysmenorrhea in which no organic lesions can be demonstrated.

#### GYNECOLOGICAL PATHOLOGY.

**Essential Uterine Hemorrhage.** Geist<sup>2</sup> reports on an investigation based upon the study of 25 uteri, in 18 instances with the adnexa, from patients on whom the diagnosis of "fibrosis uteri" had been made, the clinical pictures in these cases being strikingly uniform. The patients were all about the time of the menopause, the ages ranging between forty-one and fifty-two years, there being but two younger, one was thirty-one and the other thirty-five years of age. The chief complaint was that there had been marked menorrhagia varying from eight to twelve days, in some cases since the first period and that this symptom had become worse during the past year. Some of the women also had occasional periods of metrorrhagia. All of the women but one were

<sup>1</sup> American Journal of Obstetrics, 1915, lxxii, 945.

<sup>2</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 454.

married and had several children, and they all had previously received the usual palliative treatments, with temporary relief in some cases but recurrence in all, but none of them had been treated by the  $\alpha$ -rays. Uteri of women of all ages from fourteen to sixty years who had died from conditions other than gynecological, and in whom the menstrual history was negative, were used as controls. None of these uteri showed any gross abnormalities, nor were there any gross lesions in either the uteri or adnexa from the bleeding cases. While in practically all of the bleeding cases there was a predominance of connective tissue in the uterus, it cannot be looked upon as an etiological factor, for the same condition existed in the controls. The consideration of the occurrence, distribution, and type of elastic tissue would show that it is entirely independent of the bleeding, but that it is dependent on the involution changes which follow pregnancy. Although there was a thickening of the vessel walls, the diseased vessels are not the cause of bleeding, as they were also found in the controls, but the vessel changes are probably also due to the uterine involution following repeated pregnancies or to the many years of menstruation with its oft-repeated miniatures involutions.

The study of the endometrium revealed an interesting picture. In practically every case, the mucosa was thickened and velvety, bearing a close resemblance to the premenstrual phase of the normal menstrual cycle. The glands were numerous, tortuous and many of them cystic, which seems to be rather characteristic for the mucosa of the bleeding cases. These changes in the mucosa are not the cause of the bleeding, but simply the result, probably of the same etiological factor, for, even after a thorough curettage, the bleeding often continues unabated, or, if it does cease, it returns before the mucosa can regenerate. Examination of the ovaries in these cases offers no solution to the problem, as they showed no signs of hyperactivity, judging as we can from gross and histological examination, but, judging from the follicles, the picture is that of a regressive change. The condition is surely not due to an inflammatory change in the myometrium with fibrous replacement of the destroyed muscle or to an acute or a chronic endometritis, for there are no signs histologically of such conditions. The pathological bleeding comes on at the extremes of sexual activity; the beginning, puberty, and the end, the menopause. Coincident with these are the periods of functional change in the ovary, in one the follicular activity, in the other the follicular regression. It would seem justified in assigning an important role in this connection to the ovary, but whether the condition in the ovary is entirely the cause, or whether it is just one factor, cannot at present be stated. We do know, from experimental evidence, that the  $\alpha$ -ray affects the follicular apparatus and destroys it. We also know that bleeding due to fibroids or to essential hemorrhage can be absolutely checked by raying. This would seem to imply that it is the

follicle or its secretion, or some product of the follicle (corpus luteum) that is really at fault. It is a matter of common knowledge that insufficient raying causes an increase in the hemorrhage and would lead us to suppose that the *x-ray* in these cases produces an abnormal function of the follicle either by stimulation, when not in sufficient strength to destroy, or by partial degeneration. In short, Geist believes that in these cases of essential uterine hemorrhage, the disturbing factor should be found either in the activity of the follicular apparatus of the ovary or its product, the corpus luteum.

Recent observers seem of one accord in assigning the ovary as the cause of all uterine hemorrhages not incident to pregnancy or new growth, and the old idea of metrorrhagia being due to endometritis or myometritis is gradually being discarded. Lauth<sup>1</sup> has suggested the term *ovarian metrorrhagia* to take the place of "metritis," "endometritis" or "metropathy," since not only clinical observations, but animal experiments as well, have shown that by the injection of ovarian extract, not only all grades of hyperemia and hemorrhage but also the various changes in the mucosa and muscle, which older authors considered characteristic of primary endometritis and hemorrhagic metritis, can be produced. In many cases these metritic uteri are very difficult to differentiate from myomata, both clinically and on bimanual examination. Lauth has examined a number of metritic uteri along with their adnexa and the usual finding was a symmetrically enlarged uterus without any microscopic evidence of inflammation, associated with a cystic condition of the ovaries. In two cases there was a true metritis, in which there was a round-cell infiltration of the uterus and an increase in the connective tissue in the uterine wall. From the above reports, we can see that no definite pathology can as yet be assigned to this interesting form of uterine hemorrhage.

#### THE FEMALE URINARY SYSTEM.

**Pyelography.** When a new method of diagnosis or treatment is suggested, there is immediately a wave of enthusiasm, which, in its intensity, temporarily overlooks the dangers and disadvantages incident to such a method. For a time, these new procedures are applied indiscriminately to all varieties of cases irrespective of indications, until the more conservative members of the profession strenuously object by presenting concrete examples of mishaps which have occurred due to our inexperience and poor judgment. All new procedures seem to pass through this stage, and then finally settle down to their own proper level. One of the most recent examples of this may be found in reviewing the

<sup>1</sup> Monatschr. f. Geburtsh. u. Gynäk., 1915, xlvi, 36.

literature on pyelography. That there is much of value in the method cannot be denied, that considerable damage has been done by it must be admitted, but now we seem to have formed certain fixed ideas regarding its uses and indications and have a feeling of confidence that, in the future, the method will be restricted to properly selected cases and will be employed only by carefully trained observers.

In a rather extensive review of the literature on the subject of pyelography, Braasch and Wildner<sup>1</sup> point out that the first attempt to render the urinary tract opaque to the Röntgen ray was made by Tuffier, in 1897. Since that time many methods and materials have been used by various workers in an endeavor to perfect the technic. In order that a proper idea may be obtained of the amount of work that has been done on this subject, it may be well to mention that the following solutions have been tried, bismuth, collargol, argyrol, cargentos, nargol, electrargol, silver iodide emulsion, in addition to inflation of the urinary tract with oxygen. At the present time, after due trial of these various substances, the consensus of opinion seems to be that collargol is the best of those mentioned for this work, although it is by no means ideal. (Since this report of Braasch, a new substance has been suggested, namely, thorium, which may possibly displace collargol and which we shall mention again later.) The strength of the collargol solution that should be used varies among different workers, but probably most of them use a 10 per cent. solution, and Braasch and Wildner have found this to be the most satisfactory strength. With regard to the method to be used in filling the kidney with collargol, practically all experienced workers are agreed that the gravity method is the only safe and proper one to use, while the dangerous hand syringe must be discarded entirely. In the preparation of the collargol solution, the best technic consists in pulverizing the crystals, dissolving them in lukewarm water and then filtering the solution before use. There should be no delay in taking the röntgenogram after the catheters are in place, indeed the picture should be taken while the solution is flowing in the catheters. Pain occurring during the examination is unnecessary, and should be avoided by being careful to avoid overdistention of the renal pelvis. Pyelography has proved of diagnostic value in a normal pelvis, hydronephrosis, pyelitis, pyonephrosis, renal tuberculosis, renal tumor, renal and ureteral anomaly, mono- and polycystic kidney, identification of renal shadows, identification of ureteral obstruction, localization of renal shadows, and as an aid to ascertain renal function. Many accidents have been reported following pyelography; they have usually been due to technical errors and should not occur if the gravity method of injection is used. Among the accidents reported to have occurred following the method are infarcts, gangrene, edema, and suppuration. Five deaths have been

<sup>1</sup> International Abstract of Surgery, February, 1915.

reported as due to pyelography, all of which occurred in cases in which the hand syringe was used and in the hands of inexperienced observers. Much experimental work has been done on animals, and all the investigations show that excessive pressure forces the silver up the tubules of the kidney and the various other lesions follow in the wake of this accident. It is very evident, therefore, that unless a pyelogram is made with strict technical precautions, it may cause considerable injury. However, in the hands of those familiar with the necessary technic and the selection of cases, it has proved to be a harmless procedure. Thus, Braasch reported a series of over 1000 pyelograms made without serious results to any patient. The method is too valuable in the diagnosis of many conditions of the urinary tract to be discarded, but effort should be made to discover a substance which will not injure the kidney under any circumstances, and which may be safely employed in the hands of those with limited experience.

THE DAMAGE DONE BY PYELOGRAPHY may be quite severe as we have stated, and, in order to determine more definitely the pathological changes that are apt to occur, Keyes and Mohan<sup>1</sup> have carried on some experimental work along this line. They state that in the pathological picture of a kidney which has been injected with collargol, the surface of the organ usually shows black patches of collargol infiltration, which are slightly elevated above the surrounding tissue and consist of swollen parenchyma which is irregularly mottled with a black infiltrate. The pelvis is more or less stained and infiltrated. The collargol is found within the tubules and glomeruli, and masses of collargol are found between the tubules, and the kidney tissue about such masses is likely to be inflamed or necrotic, and the arteries and veins contain collargol. There are two explanations offered to explain the entrance of collargol into the kidney. The one is that the collargol enters the tubules and either passes up these to the glomeruli, or breaks from the tubules into the interstitial tissue and so passes along the lymph spaces to the capsule. The other explanation is that the collargol reaches the capsule *via* the bloodvessels, lymphatics and the connective tissue around the urinary canals without rupture of the tubules. Everybody now realizes that 5 c.c. is the usual safety limit for an injection, and that the gravity method is much safer than the syringe injection, but the parenchyma may be damaged even without overdistention of the pelvis. To prove this, 1 c.c. of a 10 per cent. collargol solution was directly injected into the kidney pelvis of a dog without causing tension and the kidney was immediately removed. Although the kidney did not appear congested, and no collargol was seen under the capsule or in the cellular tissue about the pelvis, microscopical examination showed that collargol was present in traces apparently in the lymph spaces near the periphery

<sup>1</sup> American Journal of Medical Sciences, 1915, cxlix, 30.

of the cortex. No trace of collargol was found in the tubules, glomeruli, or bloodvessels. In another experiment, the pelvis was distended with collargol for fifteen minutes and in this case collargol was found in the glomeruli and tubules.

From these and other similar experiments, Keyes and Mohan conclude that collargol injected under pressure is absorbed into the bloodvessels and lymph spaces about the pelvis and its appearance in the tubules and glomeruli is a *secretory phenomenon*. These are cases of primary infiltration of the kidney, which occur at the time of injection, and, clinically, are accompanied by pain at the time of injection. In contrast to these cases there is a secondary or late infiltration in which there is no pain at the time of injection, but the pain appears some time later and is due to some ureteral obstruction which causes back-pressure and absorption as the kidney continues to excrete urine. Von Hoffman had a case of this type in which the patient died from rupture of the kidney pelvis although the first pain the patient experienced occurred twenty minutes after the examination. Secondary infiltration is far more common than has been supposed, and is obviously a more serious accident than primary infiltration, since, if the kidney is not promptly drained or removed, the ureter may remain closed and the pelvis rupture. Therefore, whenever an injection is made in a case of renal retention, the patient must be kept under close observation and promptly operated upon if symptoms of acute renal retention or infection supervene. In order to prove that vascular absorption occurs in the cases of secondary infiltration, the following experiment was performed. The whole left ureter of a dog was exposed and 0.25 c.c. of a 10 per cent. collargol solution was injected into its lower end while its upper end was compressed in order to make certain that none of the solution entered the pelvis of the kidney. Pressure was immediately released above, and the ureter ligated at its lower end. Seventy-two hours later the dog was killed and both kidneys were removed. On microscopic examination of the left kidney, the most striking characteristic was the association of collargol and blood, both within the vessels and in many small hemorrhages scattered throughout the parenchyma. Collargol was also found in the straight and convoluted tubules and in the glomeruli. The *uninjected* right kidney showed collargol confined exclusively to the glomeruli and vessels, the glomeruli containing more collargol than did those of the injected left kidney. Therefore, Keyes and Mohan conclude that secondary infiltration is the cause of most of the deaths that have been reported as due to pyelography and since the cause of secondary infiltration is ureteral obstruction, it may occur when there has been no primary distention.

THORIUM IN PYELOGRAPHY. Although collargol is perhaps the most popular material that is used in pyelography, it is far from satisfactory as we have shown in the preceding pages and there has been a constant

demand for a better solution. Kelly and Lewis<sup>1</sup> suggested the use of silver iodide emulsion but it does not seem to have many adherents, although Young<sup>2</sup> of the Massachusetts General Hospital, uses it and states that it is clean, non-absorbable, opaque and gives a much better shadow with much less danger than collargol. He believes that much of the damage resulting from the use of collargol is due to the fact that it is absorbable and is taken up by the blood stream, so that silver iodide, which is absolutely non-absorbable, is a preferable solution. The ideal solution for pyelography must be non-toxic, non-irritating and quite fluid so as to immediately escape from the bladder and ureters, and present the greatest possible degree of opacity to the  $\alpha$ -ray. Most of the solutions now employed for pyelography, are precipitated on standing, are viscous and some are even irritating.

Burns<sup>3</sup> has recently reported the advantages of thorium in this work, and states that it is being used regularly in all suitable urologic cases in the James Buchanan Brady Urological Institute of the Johns Hopkins Hospital. Thorium nitrate, which dissolves readily in water, giving a clear, markedly acid solution which is opaque to the  $\alpha$ -ray, is unsuitable for use because of its irritant properties, possessing a marked degree of astringency and precipitating insoluble salts in the urine. The neutral solution of thorium nitrate and sodium citrate, however, possesses all of the necessary qualifications for pyelography. It flows readily, escapes immediately from the ureter when the catheter is removed, is perfectly clear to transmitted light, possessing a faint yellowish tinge in large volume, is perfectly clean and does not stain the clothing. From an economical standpoint, it has a decided advantage, being much cheaper than any of the silver preparations used at present, which are very expensive. The solutions used contain either 10 or 15 per cent. of thorium nitrate and are made in the following way: To make 100 c.c. of a 10 per cent. solution, 10 gm. of thorium nitrate are dissolved in as little distilled water as possible; to this solution, kept hot on a water or steam bath, are added 30 c.c. of a 50 per cent. solution of sodium citrate, the additions being made in small quantities, care being taken to shake the solution thoroughly after each addition. At first, after the addition of the citrate solution, a white, gummy precipitate is formed which later becomes granular, but finally dissolves on the addition of all of the citrate solution. This solution is then made neutral to litmus by the careful addition of a normal solution of sodium hydroxide, and made up to the required volume of 100 c.c. with distilled water. Upon filtration, a clear limpid solution is obtained, which, when sterilized, either by boiling or by steam under pressure, is ready for use. The stability of the solution is not affected in the least by sterilization. We

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1914, p. 277.

<sup>2</sup> Boston Medical and Surgical Journal, 1915, clxxii, 539.

<sup>3</sup> Journal of American Medical Association, 1915, lxiv, 2126.

have been using this solution for some months in the gynecological ward of the University Hospital, and, thus far, have been more than pleased with the results obtained and the absence of many of the annoying qualities of collargol.

**Tuberculosis of the Kidney.** In recent years the "follow up" system of recording results has very wisely been instituted in many of our larger hospitals and no doubt all surgeons feel confident that by the use of such methods we are able to accurately estimate the benefits of our treatment. The condition of a patient when discharged from a hospital is no indication of what his condition will be several months later and to record patients as cured simply because they leave the hospital improved will undoubtedly give us false statistics.

In such diseases as cancer and tuberculosis, the "follow up" system is of inestimable value, as shown by a report of Crabtree and Cabot<sup>1</sup> on the end-results of 70 cases of renal tuberculosis treated by nephrectomy. They were able to obtain definite data in 70 out of 103 cases of this disease which had had nephrectomy performed prior to December, 1912, and, as a result of careful study of this series, they have arrived at very important conclusions, briefly as follows: Young individuals with early lesions of the kidney, which usually show considerable cortical tuberculosis and perinephritis, do less well after nephrectomy than those of more advanced age in whom, however, the disease is often more extensive. The reason for this appears to be due to the extent of acquired immunity. The practicability of artificial immunization of these individuals demands consideration. Male patients offer more difficult problems in treatment than females, and the prognosis is less favorable. Genital lesions are uncommon in the female, while 32 per cent. of the male patients of this series showed genital involvement. The operation of nephrectomy for tuberculosis is not serious as regards death of the patient, the immediate mortality in this series being 3.8 per cent., and is due to pneumonia, shock and accidents, and should never exceed 5 per cent. in unilateral lesions. The late mortality, however, was 20 per cent. and was to be expected, 50 per cent. of these deaths taking place within the first two years, and the remaining 50 per cent. before five years when the lesion is unilateral. Sixty per cent. of the cases can be considered cured, although in 35 per cent. of the cases there remain legacies of the disease as evidenced by abnormal urine and persistent symptoms.

Among the most common permanent effects of the disease are nephritis probably of toxic origin, and secondary infection of the remaining kidney; irritable bladders, sometimes due to cicatrices, traces of albumin in the urine and slight pyuria. In from 10 to 15 per cent. of the cases, the progress of the disease will not be checked by nephrectomy.

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 669.

Approximately 25 per cent. of the cases heal by first intention, while in the remaining 75 per cent., sinuses develop irrespective of the method of closure employed; in undrained wounds, sinus development is late and where the "follow up" system is not carried out, there may be a false idea of the value of the method of handling the wound.

**Treatment of Tubercular Ureters.** Before the American Gynecological Society in May, 1915, the question of whether or not the ureter should be removed in performing a nephrectomy for tuberculosis of the kidney was revived. Bissell<sup>1</sup> believes that our present knowledge of the subject should lead us to the conclusion that when the kidney is tubercular, the ureter is also, in the majority of cases, at least in part of its course and often in the greater part; the most common site of involvement is the lower rather than the upper part of the organ. When the kidney alone is removed in these cases, the success of the operation is often jeopardized. It is to be admitted that if the vesicovaginal portion of the ureter be left, it becomes a possible source of progressive pathological disturbance, but in view of what has been fairly well established, namely, that the lumbar and pelvic portions of the ureter are the sources of greatest possible danger, they should receive primary surgical consideration. The advisability of removing the vesicovaginal portion of the ureter simultaneously with the removal of the kidney and the rest of the ureter, is, however, debatable. If by digital examination *per vaginam* or by cystoscopic examination and ureteral catheterization, tubercular invasion of the ureter is discovered, nephro-ureterectomy should be the operation of choice. If, previous to operation, no evidence of ureteral involvement has been discovered, nephrectomy alone should be the operation selected, but if, when the kidney is removed, there is discovered evidence of tubercular invasion in the upper part of the ureter, the removal of the entire ureteral tract is justifiable, as it is reasonable to suppose that the remainder is involved. If the immediate removal of the ureter is considered desirable, as much of the ureter should be removed with the kidney through the lumbar incision as can be reached conveniently, and then the patient turned upon her back and the pelvic portion removed through the median transperitoneal incision.

Views somewhat different from those of Bissell, and with which we are in full accord, have been expressed by W. J. Mayo<sup>2</sup> who states that, in his experience, less than 5 per cent. of the ureters in cases of tuberculosis of the kidney require removal. This 5 per cent. represents cases in which a stricture exists in the lower portion of the ureter close to the bladder, so that there is more or less retention on that side, a condition which obtains in a small percentage of the total number and which may be differentiated by ureteropyelography. Such ureters should be removed with the kidney at the previous operation. If the

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 615.

<sup>2</sup> Journal of American Medical Association, 1915, lxiv, 957.

kidney has become converted into a closed sac, the ureter will often be found to be obliterated just below the pelvis. In pure tuberculosis, the ligation of such a ureter and sterilization of the stump disposes of it safely. In the "pipe stem" ureters and all other ureters containing a lumen, but in which there is no mixed infection, the injection of from 5 to 10 minims of 95 per cent. solution of carbolic acid into the ureter with ligation, insures such a ureter and the wound against further trouble. In these two types of cases drainage is not employed. When there is secretion of urine, and especially when there is mixed infection present, in order to avoid wound infection and sinus formation, the stump of the ureter should be attached to the skin at the anterior extremity of the wound, thus permitting the safe escape of discharging fluids. This is especially desirable in cases of recent involvement of the kidney when there is considerable functioning tissue. Mayo states that in these cases, the ureter closes spontaneously in a few weeks.

In considering the technic of nephrectomy, he states that he has devised a method of ligation which obviates the dangers and disasters from slipping of a ligature from a short, thick pedicle. The vascular pedicle is exposed and freed from any surrounding fat, two hemostatic forceps are placed on the proximal side about three-quarters of an inch apart and the kidney cut away. A ligature is then thrown around the pedicle beneath the deeper pair of forceps. This pair of forceps is then removed so that the ligature slides into the groove made by them and is then tied, while the pedicle itself is still safely retained by the distal forceps. A second ligature can then be placed and the distal forceps removed as the knot is drawn tight. In cases in which only a single forceps can be applied, due to some anatomical or technical difficulty, the ligature is placed on a needle which is then carried through about one-fourth the diameter of the pedicle. Then, with a single knot, the tissues in this part of the pedicle are brought together sufficiently tightly to secure a good hold; the ligature is then brought around the opposite side of the pedicle and a single knot made. The forceps are slowly loosened and the ligature drawn home; both sides of the pedicle are thus drawn tight and the pedicle cannot slip. Mayo gives the credit for this latter procedure to Professor Graser, of Erlangen.

**Significance of Tubercl Bacilli in the Urine.** Lawrason Brown,<sup>1</sup> of Saranac Lake, whose experience in tuberculosis renders his opinions authoritative, states that in order to exclude the smegma or other acid-fast bacilli when examining urine for the presence of the tubercle bacillus, the urine should always be obtained from women by means of ureteral catheterization. When urine obtained in this manner from a case presenting symptoms of cystitis, is inoculated into the usual culture

<sup>1</sup> Journal of American Medical Association, 1915, lxiv, 886.

media and produces no growth, tuberculosis should be strongly suspected, in fact many observers hold such a condition as direct evidence of tuberculosis. He who would base an opinion on the presence or absence of tubercle bacilli in the sputum on the examination of one specimen would be ridiculed; the same views should be held regarding the presence or absence of tubercle bacilli in the urine. That they may occur for a time and then disappear entirely cannot be denied, and the occurrence of so-called "showers" of tubercle bacilli is common knowledge. Even good laboratory men, however, do not always bear this in mind and do not hesitate, in some instances, to deny the presence of tubercle bacilli in the urine after one or two examinations. When acid-fast bacilli are found in the urine, the sediment from large quantities of freshly collected urine should be inoculated subcutaneously into several guinea-pigs, which should become tuberculous before a diagnosis of tuberculosis is made, according to most observers. Although Brown has great respect for the results of this animal inoculation test when positive, he does not believe that a negative test excludes tuberculosis.

With regard to the treatment of renal tuberculosis, although Brown is an internist, he believes that a prompt nephrectomy offers the best prognosis, and compares the 69 per cent. of cures from surgery with the 10 per cent. of cases that remain alive more than five years from medical treatment. After the nephrectomy has been performed, supplementary treatment by means of injections of tuberculin should be instituted. Brown believes that the reported spontaneous cures from renal tuberculosis are, in most instances, mythical, which means a great deal when we consider that such a statement comes from the internist.

**Renal Calculus.** Cabot<sup>1</sup> has made a critical review of 157 cases of renal and ureteral calculi occurring in the surgical service of the Massachusetts General Hospital during the seven years prior to 1914. The results of this study indicate that the greatest number of patients have come for operation between the ages of twenty and forty, and that between the ages of twenty and fifty there were 128 out of 153 cases in which the age is noted. But, on the other hand, considering the time of the onset of symptoms, we note that the condition occurs at a much earlier period. A large number of cases undoubtedly begin between ten and twenty, the largest number is found between twenty and thirty, while between ten and forty there occurred 120 out of 153 cases; after forty, the frequency of occurrence of stone of sufficient size to require operation fell off very rapidly. There were 108 men and 46 women in this series, which does not agree with the figures of most other observers and is perhaps due to the small number of cases. The right side was more frequently involved in women, and the left side in men. The frequency of involvement of the right side in women is due, Cabot

<sup>1</sup> Journal of American Medical Association, 1915, lxv, 1233.

believes, to the more frequent occurrence of mobility of the right kidney with accompanying renal retention in this sex.

**SYMPTOMS.** Pain, which could be described as colicky, occurred at some time in 96 cases, or about two-thirds of the total. It was the presenting symptom, however, in only 50 and in the remainder was an occasional or unimportant symptom and frequently elicited only on careful questioning. In the remaining cases the presenting symptom was as follows:

Dull pain referred to the region of the kidney . . . . .	32
Pain in the right lower quadrant . . . . .	12
Backache . . . . .	8
Pain referred to the bladder . . . . .	7
Hematuria . . . . .	7
Vague abdominal pain . . . . .	4
Pain in the sacro-iliac or lumbar region . . . . .	3
Epigastric pain . . . . .	2
Chills and fever . . . . .	1
Vomiting . . . . .	1

Accurate examinations of the urine were carried out in 150 cases, with the result that the urine was found entirely and persistently normal in 22, or 14 per cent.; contained albumin in varying amounts in 111, or 74 per cent.; blood was present either grossly or microscopically in 103, or 68 per cent., and pus was present in 109, or 72 per cent. Of the cases showing a persistently normal urine, 15 were cases of stone in the ureter, and 7 were cases of stone in the kidney. Röntgenograms were made in 127 cases, of which 8, or over 6 per cent., were persistently negative. This showing is probably more favorable than will be found in a larger series of cases, and Cabot believes that the Röntgen ray, as used at the present time in competent hands, fails to detect stone in from 10 to 15 per cent. of the cases. Of the 140 cases operated upon, there were 5 deaths, a mortality of a little over 3 per cent., 2 deaths occurring after nephrectomy and 1 each after pyelotomy, ureterotomy, and nephrotomy. In only 2 cases was there postoperative hemorrhage of notable amount, but in neither of these was the outcome fatal. After having tried the various operations in the treatment of renal calculi, pyelotomy is now regarded by Cabot as the operation of choice in all cases in which the stone can be extracted through the pelvis. In none of the cases was there the formation of a urinary fistula, so that, with modern technic, this complication may be disregarded. One of the most striking facts brought out by this investigation was that a considerable number of these patients had been subjected to previous operations without relief, for symptoms afterward proved to be due to stone in the kidney or ureter. Twenty-six patients had had such operations, distributed as follows:

Appendectomy . . . . .	10
Exploratory laparotomy . . . . .	7
Fixation of the kidney . . . . .	4
Operation for gall-stones . . . . .	1
Adhesions not found to exist . . . . .	1
Decapsulation of the kidney . . . . .	1
Salpingo-oophorectomy . . . . .	1
Suprapubic cystotomy . . . . .	1

Eighty-five patients were examined more than two years after operation, this examination including a general physical examination, examination of the urine, and an *x*-ray examination. Patients were classified as well who showed a normal urine and a negative *x*-ray picture. Patients were classified as not well when the urine showed pus, blood or albumin, and the *x*-ray showed a shadow, probably a stone. Of 64 patients operated upon for stone in the kidney, 33, or 51 per cent., were well, and 31, or 49 per cent., were not well. Of 21 patients operated upon for stone in the ureter, 15, or 71 per cent., were well, and 6, or 28 per cent., were not well. These statistics again show the importance of the "follow up" system. As a final word, Cabot states that while the *x*-ray examinations may be persistently negative in enough cases to make it dangerous to depend wholly on this evidence, the combination of unusual pain symptoms, a negative *x*-ray and a persistently normal urine is fortunately rare.

**RENAL CANCER ASSOCIATED WITH RENAL STONE.** Further evidence in substantiation of the irritation theory of cancer has been brought forward by Coryell<sup>1</sup> in a study which covers all cases of renal cancer and renal stone from which tissue was removed in the Mayo Clinic from January, 1905, to July, 1914. There was a total of 145 cases studied, of which 131 were of stone only, 5 of cancer only, and 9 of cancer associated with stone. The study revealed that renal epithelium not infrequently regenerates, the tubules often regenerating as a whole; the stages of development of renal epithelium under the influence of prolonged irritation are (1) normal; (2) inflammatory; (3) hyperplastic; (4) neoplastic (which may be either benign or malignant). In the kidney there seems to be no distinct line of demarcation between certain stages of a chronic inflammatory process and neoplasm formation, and it is impossible to say where normal processes cease and neoplastic processes begin. The preparatory phenomena of renal new growths seem to take place not in the area actually irritated, *i. e.*, not in the area which shows actual inflammatory reaction, but just beyond the same. Even if heredity plays the same role in human cancer as it does in mouse cancer, chronic irritation in the kidney is still of very great importance, in that it determines the location of the neoplasm. There is at times an attempt on the part of the neoplasm to mimic the structure

<sup>1</sup> Bulletin of Johns Hopkins Hospital, 1915, xxvi, 93.

of the kidney by a columnar arrangement of cells and the formation of a lumen, although renal cancer develops from the epithelium both of the pelvis and of the tubules. In all the specimens studied, the kidney showed an inflammatory reaction in some portion. The destruction of the renal substance varied in degree and was brought about by interstitial or parenchymatous changes, or both, and suppuration was of frequent occurrence. Under the influence of stones, the epithelium of the renal tubules may necrose, form cysts or become malignant. The important deductions to be drawn from the study, however, is, as Coryell states, that after having seen the gradual changes from normal tissue to inflammatory, from inflammatory to hyperplastic, and from hyperplastic to neoplastic, it appears probable that the chronic irritation brought on by the stones was the direct cause of cancer. Of the total number of kidneys with cancer that were removed at the Mayo Clinic, 64 per cent. were associated with stones, while only 35 per cent. were without stones.

**RECURRENT OF RENAL CALCULI.** Cabot and Crabtree<sup>1</sup> have studied the patients operated upon for stone in the kidney or ureter at their clinic during the eight years previous to January, 1914, thus excluding cases recently operated upon. The list includes 155 cases, but it was impossible to obtain the actual presence in the clinic of more than 87 patients, therefore the conclusions are based on that number. In patients under thirty-five years of age, the probability of recurrence is comparatively large, while in patients over forty, the probability of recurrence is comparatively small. This but follows out the well-known fact that the majority of stones in the kidney form between the ages of fifteen and thirty-five years, and that after that age, stone formation in the kidney becomes markedly less probable. On the basis of these findings we should not be too optimistic, but should tell our patients that the risk of operation is small, that the danger of progressive destruction of the kidney by the stone, if it is left, is large, that the probability of recurrence is considerable, that it depends somewhat upon the age, undoubtedly somewhat upon the method of operation and the skill with which it is carried out, but clearly upon the entirely unknown factor—the liability or the ability of that particular kidney to form concretions. The actual figures which show the number of cases which were not well after an operation for renal calculus we have already shown (1st paragraph, page 303).

**Ureteral Calculus.** Almost any statistical report which emanates from the Mayo Clinic is both of interest and value on account of the large material on which the report is based, and also because of the accuracy and care displayed in the study. Therefore it is with pleasure that we review a series of 294 cases of stone in the ureter which has

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 223.

been reported by Braasch and Moore.<sup>1</sup> In ureteral calculus, pain is caused either by intra-renal tension as a result of urinary obstruction or by localized infectious changes in the ureter. In this series, pain was referred largely to the renal area in 197 (67 per cent.) of the cases; to the upper abdominal quadrant in 45 (15 per cent.) of the cases; to the region of the lower ureter in 28 (9 per cent.) of the cases; and to the suprapubic area in 3 cases. No definite radiation of pain was reported in 16 cases, and no pain whatever in 5 cases. It is probably true that renal colic as a result of lithiasis is caused more frequently by stone lodged in the ureter than in the kidney. Of particular interest is the localization of pain referred to the area of the lower ureter. It is probable that this group of cases is most frequently confused with appendicitis, particularly when the pain is on the right side. The localization may be so suggestive of appendicitis that, in case the urinalysis was negative, an exploration of the appendix might be justifiable without preliminary röntgenographic examination.

Vesical irritability was reported in 218 patients (74 per cent.). This condition is such a frequent occurrence that its absence is of distinct value in differential diagnosis. The practical value of the presence of a few red blood cells or pus cells in the urine in the diagnosis of ureteral stone has been exaggerated, although their presence necessitates a careful röntgenographic examination of the urinary tract even though the subjective symptoms are of negative value. On the other hand, the absence of pus or blood cells would not exclude the possibility of stone in the ureter. Gross hematuria was reported in 41 (14 per cent.) of the cases, as compared with its presence in 56 per cent. of cases of stone in the kidney which Braasch has previously studied. In 32 female patients, palpation *per vaginam* was employed, but in only 7 (22 per cent.) was the stone definitely felt. In a few other cases an area of thickening could be felt in the vault of the vagina, but was not definite enough to be of practical value. In order to be definitely felt *per vaginam*, the stone should be at least a centimeter in diameter, and should be situated within, or immediately adjacent to, the wall of the bladder.

Regarding the treatment of ureteral calculi, we should remember that in all probability the majority of stones in the ureter pass spontaneously, and, for this reason, surgical interference is seldom indicated with the first attack of pain. While no rule can be adopted, it would be rational, in the majority of cases, to wait at least two or three months until nature has made several attempts to dislodge the stone. On the other hand, repeated violent colic, the danger of renal destruction and other complications as the result of an obstructing stone may necessitate its removal before this period has elapsed. Before an abdominal operation is attempted, however, the passage of the stone may be aided by

<sup>1</sup>Journal of American Medical Association, 1915, lxv, 1234.

the various methods offered by endoscopic technic, namely, catheter manipulation, injection of sterile glycerin or oil, fulguration, ureteral dilatation, cutting of the meatus, and ureteral forceps.

In this series of cases the röntgenographic report was negative in 32 (11 per cent.), of the cases, the failure to show the stone being due to errors in röntgenographic technic, position of the stone, size of the stone or the character of the stone. While it is likely that some of the cases which are negative to the  $x$ -ray could have been made positive by technical refinements, there will probably always be a small percentage of cases in which the stone will not be detected by this method.

In 64 cases the stone was removed from the ureter by cystoscopic methods, while in the remaining 230 cases, which were operated upon, the localization of the stone in the ureter was as follows:

Ureteropelvic juncture . . . . .	26 cases
Upper third . . . . .	28 "
Middle third . . . . .	1 case
Lower third . . . . .	159 cases

This last group, which is the largest, was subdivided as follows:

Iliac crossing . . . . .	4 cases
Pelvic portion . . . . .	90 "
Ureterovesical juncture . . . . .	41 "
Intramural . . . . .	22 "
Meatus . . . . .	2 "
Not definitely located . . . . .	3 "

Another plea for the removal of ureteral stones by cystoscopic methods has been made by Lewis.<sup>1</sup> He calls attention to the fact that the mortality from open operation for ureterolithotomy is between 15 and 20 per cent., and states that the cystoscopic method of removal of stones is of more advantage than the expectant method of treatment and considerably less hazardous than the open operation. Furthermore, if the method is unsuccessful, it does not render later operation any more dangerous. Lewis uses and describes his own 1914 model combined direct and indirect operating cystoscope for this work.

**SPECIAL MEANS OF DIAGNOSIS OF CALCULI.** It is impossible, as Braasch and Moore have shown, to make a diagnosis of the position or even the existence of a ureteral calculus by the character and location of the pain. For the diagnosis, we have come to depend almost entirely on the data furnished by special methods of exploration and examination. Of the diagnostic methods at our command, *röntgenography* holds the position of most importance, but, for satisfactory results, it requires the skill of the most expert workers, skill both in technic and in interpretation, because the sources of error are many. In a series of 67 cases

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 462.

reported by Geraghty and Hinman<sup>1</sup> in which careful and repeated röntgenograms were made, and only those accepted which were perfect, röntgenography missed the stone in 15 cases (22.4 per cent.) which is a much greater percentage than is generally known. The commonly accepted opinion that only uric acid calculi are apt to be overlooked is not true. The great frequency of shadows in the pelvis close to the line of the ureter, renders the diagnosis of stone in this portion of the ureter particularly hazardous from the x-ray alone. These shadows, the results of phleboliths, calcified glands or other causes, are most often located opposite the spine of the ischium and a knowledge of their frequent existence renders it necessary, in the majority of cases, to employ other methods of diagnosis.

For the demonstration of the presence of ureteral calculi, the *wax-tipped catheter* excels in accuracy any other known method and should be employed in all suspected cases in which the skiagram is negative or doubtful. The technic which Geraghty and Hinman employ in the use of the wax-tipped catheter consists in passing the catheter into the bladder in the same manner as a filiform bougie is passed. The butt end is threaded backward into a catheterizing cystoscope, which is then passed into the bladder over the catheter as a guide. At no time must the wax portion come in contact with the metal of the instrument. After the instrument is in the bladder, the catheter is slowly withdrawn until the wax tip appears in the cystoscopic field, when it should be carefully examined to preclude the possibility of its having been scratched by any of the previous maneuvers. After the examination, the instrument is removed first and then the catheter. As a rule, scratches produced by the contact of a stone are very definite and unmistakable, and, by means of this method, Geraghty and Hinman have diagnosed ureteral stone in 6 cases in which the x-ray was completely negative, during the past two years. In the many cases in which the wax tip has been employed, in only one did it fail to demonstrate a stone when present. The discovery of a small calculus in any portion of the ureter is no positive indication for immediate procedure, but when the calculus is too large for passage, or if the patient is having repeated colic, or when the symptoms have been present over a long period of time without the passage of the calculus, one is justified in operating. They consider that a more useful procedure is the passage of a catheter, which one of them has specially designed, to apply heat to the wall of the ureter and thereby cause muscular relaxation. The catheter is made of flexible wire, through which an electric current is passed and the degree of heat obtained is indicated by means of a special thermometer.

**Effect of the Colon Bacillus on the Kidney.** In an interesting series of experiments on 100 animals, Koll<sup>2</sup> made an effort to determine the

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 515.

<sup>2</sup> Journal of American Medical Association, 1915, lxiv, 297.

comparative effect of the colon bacillus, the typhoid bacillus, and the staphylococcus on the kidney under different conditions. He first injected a twenty-four-hour colon bacillus culture into one ureter below the pelvis, and removed the affected kidney, along with its fellow of the opposite side, at varying intervals in the different animals. In some cases there was no ureteral obstruction, while in others an obstruction was produced either by narrowing the ureter with a ligature, or else by placing a small pebble in the pelvis. In the cases in which the ureters were obstructed, a pyonephrosis was produced routinely. In the cases in which there was no obstruction, he consistently found a glomerular nephritis in both kidneys, the infiltration being of the polynuclear type in the kidney injected while the opposite kidney showed a mononuclear infiltration. In all the cases in which the kidneys were removed after twenty-four hours, the inflammation was not limited to the pelvis, but a pyelonephritis was found, but in none of these cases could bacteria be demonstrated in the tissues or be obtained by culture from the urine. In those cases in which the opposite kidney was allowed to remain *in situ* after removal of the injected one, there was always a restoration to the normal histology, thus bearing out a clinical fact that, after removal of a surgical kidney, the toxic nephritis in the opposite kidney disappears.

The typhoid bacillus produced a more generalized parenchymatous nephritis, while the staphylococcus produced either a focal necrosis or a complete pyonephrosis. In other animals, he injected the cultures into the sheath of the ureter extraperitoneally or else subcapsularly at the cortex, and the results were the same as in the cases where the culture was injected directly into the ureter. In the final series, he injected soluble toxins of the three organisms and in all of these cases he obtained a parenchymatous nephritis of varying degree, the type of infiltration being lymphocytic rather than polynuclear. This involvement was in both kidneys, but they all became normal in three or four weeks. This work shows that a kidney is able to spontaneously overcome infection in the absence of trauma or obstruction, and that infection travels in the kidney by way of the blood stream, since the glomeruli are the structures mostly involved.

**Dermoids of the Kidney.** Baldwin<sup>1</sup> comments on the scarcity of dermoids of the kidney and cites 5 cases which are all that he could collect from the literature and then adds a case of his own. The history is that of a girl, aged sixteen years, who had had an abdominal tumor since she was two years old, which was at that time the size of a hen's egg. It had been growing slowly, but of late had taken on rapid growth until now it was the size of a cocoanut, in the right side of the abdomen, but could be pushed freely in all directions. Her general health was

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 219.

perfect. The kidney was removed and the tumor found to involve its lower half. The walls of the tumor consisted largely of bony plates and the interior had many cavities containing different colored fluids filled with cholesterin crystals, but there was no hair present.

**Tumors of the Bladder.** PATHOLOGY. In from 30 to possibly 50 cent. of the cases of primary carcinoma or changed papilloma of the bladder in a series of cases studied by Buerger<sup>1</sup> the condition was preceded by papilloma. From a study of the pathology of 113 tumors of the bladder, among which there were 55 papillomata, 45 papillary carcinomata, 5 squamous carcinomata, 2 metastatic carcinomata and 6 sarcomata, Bürger was able to conclude that a differential diagnosis between papillomata and carcinomata can be made in almost all instances on a pathological basis. Certain morphological criteria were accepted as indicating the existence of the acquisition of malignant traits in any given tumor. These criteria were found to be present in parts of the tumor that were accessible, in so far as they can be reached by cystoscopic instruments, and in so far as adequate portions can be removed for histological examination. The changes that are indicative of malignancy occur, not as heretofore assumed, in the *depth* where they may escape our diagnostic methods, but manifest themselves first in the epithelium not far from the surface, either with, or without, areas of infiltration. A test of the morphological criteria proved conclusively that they are dependable, and, if adopted, lead to correct diagnoses. Only in one tumor out of 113 was a papilloma found to infiltrate and still retain "normal" cellular characteristics.

FULGURATION TREATMENT. The results of this mode of treatment for bladder papillomata have been so uniformly satisfactory that, according to Kretschmer,<sup>2</sup> modern urinary surgery absolutely demands this form of treatment in these types of tumors. Although the method is not so universally applied in Europe as it is in this country, the results of its use are being reported more and more frequently, and it is safe to assume that within a short time it will enjoy the wide application abroad that it does in America. Nothing has stimulated the general interest in the treatment of papillomata as has the use of the high-frequency current, which fact is evidenced by many recent publications dealing with the subject. Of prime importance with this, as with any other form of treatment, is the fact that its success depends on a careful judicious selection of cases. This was early recognized by Beer, the originator of the treatment five years ago, when he stated that all malignant cases should be excluded from treatment. In order to determine the nature of the tumor, whether benign or malignant, it has been suggested that a small piece of the tumor be removed by means of an operating cystoscope for histological study. This procedure

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 179.

<sup>2</sup> Journal of American Medical Association, 1915, lxiv, 1050.

has been condemned by many as being not only unsatisfactory but positively dangerous. The best results have been obtained in papillomas of primary growth or in papillomas that have been previously operated upon, that is, in cases with recurrences, and it is very interesting to note that nothing but good results have been reported from this method of treatment.

This subject was the topic of a symposium held at the meeting of the American Urological Association in April, 1915. Geraghty,<sup>1</sup> who presented a paper at that time, stated that in 68 cases of bladder tumor seen in the past four years at the Urological Clinic of the Johns Hopkins Hospital, fulguration had been employed in 47, and, in 36 of the 47, the tumors were papillomata. In 10 cases the tumors were either hard, lobular, infiltrating carcinomata, or diffuse, papillary carcinomata associated with more or less extensive infiltration of the bladder wall. Of the 36 papillomata, histological study of the tumor was made in 25 cases, of which 8 were typical benign papillomata and 17 were malignant papillomata of varying degrees of malignancy histologically. In 7, of the 8 cases of benign papillomata, the tumors disappeared in from 2 to 5 treatments, and up to the present time there have been no recurrences observed in this series. In all of the 11 cases of papilloma which were not examined histologically, the tumor has disappeared and none have recurred. In 7, of the 16 cases in which a histological diagnosis of malignant papilloma was made, the tumors were multiple, in one of these cases more than a hundred small tumors were scattered in all portions of the bladder. Five of these 16 cases had had previous operative treatments of varying kinds. In 10 cases the tumors were entirely destroyed, 1 case is still under treatment, and 1 case died while under treatment but from another cause. In 2 cases the tumors absolutely resisted the treatment; in 1 case the treatment was discontinued on account of the patient's general condition, although the treatment was satisfactory; in 1 case the bladder was opened and the tumors fulgurated through the incision, with satisfactory results. There has been a recurrence in 4 cases. In 11 cases of hard, lobular carcinomata, there was not the slightest benefit obtained from the treatment, and, besides, it was very painful.

In the vast majority of cases it is possible to differentiate between *papillary carcinoma* and *papilloma*. The cystoscopic examination in most instances, combined with the histological picture and the various clinical data obtainable, such as infiltration of the bladder wall, which can be detected so frequently when the tumor is on the posterior or posterolateral wall, gives the necessary information, but an absolute diagnosis can only be made by a most careful microscopic study which sometimes necessitates the study of sections from various portions of

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 150

the tumor. The old view that the nature of the tumor is to be decided upon especially after examination of the base is entirely erroneous. It has now been repeatedly proved that the base of a papilloma may show no signs of infiltration, and still the tumor be distinctly malignant in its body and periphery. When infiltration of the base does occur, the tumor ceases to be a true papilloma and becomes rapidly sessile—a distinct papillary carcinoma. Probably in no other tumor have so many mistakes been made by the best pathologists. It should be emphasized that in papillomata, evidences of epithelial proliferation in the connective-tissue stalks is not necessary for the diagnosis of malignancy and that every papilloma that shows the slightest change, either in arrangement, shape, size or staining properties of the epithelium, should be looked upon as malignant. When the tumors are cystoscopically and histologically benign, the rapidity of disappearance under treatment is frequently astonishing. When, however, the papillomata are malignant, the response to fulguration may be extremely slow, and lead almost to discouragement. Geraghty believes that it can now be positively stated that fulguration should be the treatment selected for all papillomata, benign or malignant, in which infiltration of the bladder wall has not occurred, and that it yields results incomparably superior to the most radical operative procedures.

In this same symposium, Keyes<sup>1</sup> also stated that the clinical experience thus far accumulated impresses one with the conclusion that a vicious malignant tumor, no matter how small it be, cannot be controlled by electricity in any form. The four contraindications to cystoscopic treatment which Keyes believes are absolute are hardness of the tumor, intractable cystitis, sloughing or ulcerated tumor and multiplicity and size of the tumors, although occasionally there may be cases in which some of these contraindications may not be absolute. We must always be on the lookout for carcinoma, and a tumor, however small and apparently superficial, that resists desiccation must be promptly excised.

**Rare Type of Bladder Ulcer in Women.** Hunner<sup>2</sup> describes a type of ulcer which he has observed in eight women and which differs in several ways from the solitary ulcer of Fenwick. There is no apparent cause for the ulcer, and the average age at which the ulcer appears is twenty years. It is always found in the summit, or free portion of the bladder, in contradistinction to the ulcer of Fenwick which is found in the fixed portion or base of the bladder. The history is one of insidious onset, without apparent cause, and long duration in spite of various forms of treatment, and all of the cases have had signs of chronic urethritis. The most characteristic feature is the insignificance of the lesion as compared with the long duration and the intensity of the patient's suffering. There may be slight, smooth, white scars of former ulcerations

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 169.

<sup>2</sup> Boston Medical and Surgical Journal, 1915, clxxii, 660.

as well as slight hyperemia or inflammatory spots near these scars. In other cases there is a small granulation area which bleeds on account of the distention of the bladder or will bleed easily on being touched, or the inflammatory spot may be surrounded by edema. The urine from such a case is macroscopically normal, but the centrifuged specimen shows a few leukocytes and red blood corpuscles under the microscope. The diagnosis depends mainly on its resistance to ordinary forms of treatment. The best treatment in these cases is excision of the ulcer through a suprapubic incision, operating extraperitoneally.

**Exstrophy of the Bladder.** This condition is seen clinically as a congenital absence of the lower abdominal wall and the anterior wall of the bladder in the mid-line and is often associated with other congenital anomalies, such as hernia, rectal prolapse and abnormal communications between the bladder and the small and large intestines. In females, the internal genital organs are often cleft. The surgical treatment of this condition is often very disappointing, and the condition is a dangerous one on account of the danger of ascending infection.

Heinsius<sup>1</sup> reports a successful operative result in a well-developed girl of six years, in whom no other defect was present. Her parents, brothers and sisters were all well developed and perfectly normal. She had been previously operated upon, though unsuccessfully. Heinsius followed the idea of Trendelenburg of closing the cleft in the abdominal wall by means of the application of a special abdominal belt or girdle which was gradually tightened, thus approximating the pubic bones. Later, under chloroform anesthesia, the sacro-iliac synchondroses on each side were cut and the pubic bones forced nearer together. At the beginning of the treatment, the gap measured several centimeters, but at the end of seven months it was only about 2 mm. between the pubic bones, and the bladder was entirely covered. The child could then urinate *per vias naturales*, and, although three years have elapsed since the operation, the child is developing normally and seems perfectly healthy.

**The Tabetic Bladder.** According to Koll,<sup>2</sup> there is a typical cystoscopic picture in tabes which is often a means of diagnosis before there are any other clinical signs. The bladder changes consist of an unusual trabeculation characterized by a lateral grouping of the trabeculae. The area occupied by the interureteric ligament is practically free from trabeculae, stands out very prominently, and seems to form a line of demarcation between the trigone and vertex, and the bloodvessels along this line are increased in size and number. The ureteral orifices are either partially or widely gaping and the rhythmic contractions are either sluggish or absent. Although tabes is comparatively rare in women, the importance of keeping it in mind is shown by one of Koll's

<sup>1</sup> Berl. klin. Wehnschr., 1915, lii, 203.

<sup>2</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 176.

25 cases in which a female, thirty-eight years old, had severe attacks of what appeared to be typical renal colic. The x-ray examination was negative, and the urine contained no pus or blood, but the cystoscopic examination showed the above described picture and tubercle was diagnosed. The Wassermann examination was then performed and found positive, and, after four injections of neosalvarsan, all of her symptoms disappeared.

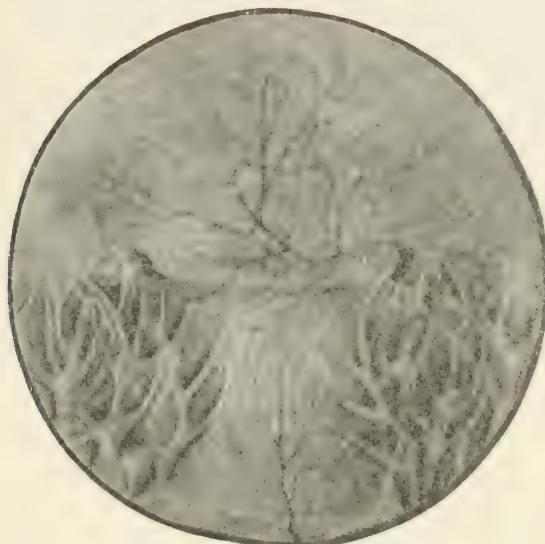


FIG. 111.—Cystoscopic picture. (Koll.)

**Solution for Bladder Irrigation.** The requisite of an irrigating solution in cystitis in women is that it should be non-irritating, easily obtained, antiseptic, stimulating and healing to the inflamed surfaces. Of all the solutions that have been recommended, McDonald<sup>1</sup> believes that *quinin bisulphate* best fulfills these requirements. It is one-half as germicidal as pure phenol and will inhibit the growth of fresh typhoid cultures in a 1 to 30,000 dilution. It may be used in irrigating in a strength of 1 to 2000 without any noticeable irritation.

**Urethral Caruncle.** Young<sup>2</sup> reports a series of 74 cases of urethral caruncle, in which microscopic sections were made in 19 cases and in these more than 25 per cent. showed irregularity of the cell growth which raised a question of carcinomatous degeneration. The ages of the patients varied from six to sixty-three years. There were 26 cases (35 per cent.) which had no symptoms of any kind pointing to the caruncle, the growth being discovered and removed incidentally during

<sup>1</sup> Journal of American Medical Association, 1915, lxiv, 505.

<sup>2</sup> Boston Medical and Surgical Journal, 1915, clxxii, 822.

other operations. Of the cases that had bladder symptoms, burning and frequency of urination were the most common complaints, while incontinence of urine and hematuria were occasional symptoms throughout the series. The average duration of symptoms was between three and four months, and, in one-third of the cases, the growth had been removed one or more times prior to the present operation. The type of operation performed does not seem to have any bearing on the possibility of recurrence, as excision and actual or chemical cauterization have all been equally tried. In those cases in which there was a strictured urethra which was not remedied at the first operation, the caruncle always returned, but, other than this, no cause for recurrence could be determined. The age of the patient had no bearing on the symptoms or pathology, nor was there anything in the series that could throw any light on the etiology of this annoying condition. In 1 case only was trauma given as the causative factor. The treatment of this condition should consist of removal of the growth in any manner whatsoever, followed by the passage of sounds into the bladder in order to make certain that the urethra is not strictured.

#### ANESTHESIA.

There seems to be a great desire especially on the part of European gynecologists, to avoid the use of a general anesthetic even in abdominal surgery and considerable work is being done on the subject of anesthesia with especial reference to nerve blocking, sacral and conductive anesthesia, so that we feel although we are opposed to the method in general that a review of the gynecological literature would hardly be complete without at least a few remarks pertinent to this field.

**Sacral Anesthesia.** In the Dresden Frauenklinik since 1912, Kehrer<sup>1</sup> has used sacral anesthesia in many of his cases and considers it free from the dangers of lumbar anesthesia. In the beginning of his work, the assistant attended to the administration of the anesthetic and the results were not so good as expected, but since the beginning of 1914, he has given all of the injections himself and the results have been much more satisfactory. This is not meant to reflect on the assistant, but simply means that conditions are much more uniform when the same man gives all of the anesthetics. In this series, 82 per cent. of the anesthetics were most satisfactory, indeed wonderful, and Kehrer believes that this figure would have reached 95 per cent. if the same man had given the anesthetic throughout the series. The solution cannot reach the medulla as is possible in lumbar injections, on account of the thick sheaths of the nerve trunks. This has been proven experimentally

<sup>1</sup> Monatschr. f. Geburtsh. u. Gynäk., 1915, xlii, 95.

by the injection of novocain solution colored with methylene blue and observing the failure of the stain to reach the medulla.

TECHNIC. The patient receives veronal the night before operation, and scopolamin and morphin on the morning of operation. For the puncture, there are three different sized needles, 8, 9 and 12 mm. long,

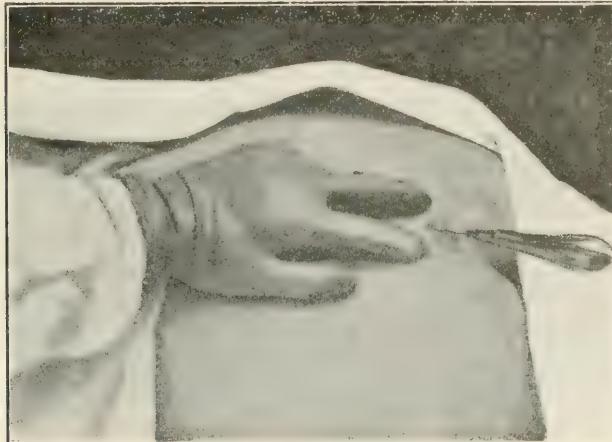


FIG. 112.—(Kehrer.)

the latter seldom being necessary except in fat women. The operation can begin in ten minutes after the injection. In making the injection, the index and middle fingers of the left hand locate the lower sacral cornua. Between these fingers is the location of the occluding membrane



FIG. 113.—(Kehrer.)

of the sacral canal, or "fontanelle" as it is called. The needle is then introduced here in the mid-line at an angle of 20 to 30 degrees pointing in the direction of the last vertebra. After passing through the membrane, the needle is introduced about 4 cm. up the canal, keeping in mind that the canal is curved and taking care that the needle is not

arrested in the periosteum of the anterior wall of the canal. If the fluid in the syringe, which is now attached to the needle, flows by applying only a moderate amount of pressure, the needle is in the canal, but if considerable pressure is needed, the needle is caught in the periosteum. Although others have had trouble with this method of anesthesia, Kehrer has never experienced any difficulty in its employment. In a few cases there is a headache for a few hours after the operation, and, in 2 cases of the 140 of the series, a trophic ulcer developed over the sacrum, but both of these cases were cachectic individuals in whom part of the fluid had been accidentally injected outside of the sacral canal. The patients sometimes complain of a little discomfort if the parietal peritoneum is traumatized or if the cardinal or infundibulopelvic ligaments are pulled on. The method has been tried out successfully, not only in vulvar, vaginal and rectal cases, but also in all of the major gynecological laparotomies. The solution used is usually 60 c.c. of a 1½ per cent. novocain sodium bicarbonate solution representing 0.9 gm. novocain. In very weak patients only 53.3 c.c. or 0.8 gm. novocain are used, which Schlimpert says should be the maximal dose in any case, so that, in Kehrer's average cases, larger doses are used than have been heretofore recommended and, by this means, the same anesthesia is produced as in lumbar injections. It is not necessary to place the patients in the knee-chest position but by placing them on the side with the back bent and the legs drawn up under the body, the injection may be easily made. The anesthesia usually lasts from sixty to seventy minutes. The summary of Kehrer's results in 140 cases is:

Complete anesthesia . . . . .	67.1	per cent.
Good anesthesia but on account of the length of operation completed under inhalation narcosis . .	15.0	"
Slight anesthesia but had to resort to inhalation narcosis early in the operation . . . . .	10.0	"
Complete failure (often due to technical error) . .	7.8	"

IN THE FREIBURG CLINIC up to 1912, according to Schloessingk,<sup>1</sup> there were 2542 cases of spinal anesthesia without a death, and but 2 cases of paralysis of respiration requiring resuscitation. The most important factor for success is not the anesthetic selected, but the solvent, the specific gravity, freezing point, temperature at the moment of injection and the position of the patient during and immediately after the injection. At Freiburg the patients are all placed in "Dämmerschlaf" with morphin and narcophine before the injection is given, but the remainder of the technic is practically the same as we have already described. This method of anesthesia causes a fall in blood-pressure, as evidenced by a persistent pallor in many cases, therefore it is contraindicated in severe cardiovascular disease.

<sup>1</sup> Illinois Medical Journal, 1915, xxvii, 111.

In order that we may have an idea of the widespread employment of these methods in other countries, it may be well to quote the statistics of Holzwarth.<sup>1</sup> In a series of 1438 operations of all varieties, local or conductive anesthesia was employed in 94.73 per cent. of the cases, the remainder being performed under a general anesthetic. Of the 1367 cases operated upon under local anesthesia, 296 were operations involving the abdominal cavity and 324 involved the abdominal wall.

**AN AMERICAN REPORT.** Basing his views on 217 operations, many of which were gynecological in character, which he has performed under conductive anesthesia, Harris<sup>2</sup> states that the advantages of the method over general anesthesia are that it is safer and is devoid of the dangerous and unpleasant complications which frequently follow general anesthesia. The patients recover from the effects of the anesthetics much quicker, and, if the nerve blocking has been complete, no shock follows the operation save that due to the loss of blood. On making an incision through the abdominal wall, it is found that the skin is most sensitive, the subcutaneous fat is but slightly sensitive while the muscle and parietal peritoneum are quite sensitive. The complete absence of rigidity and of increased abdominal tension is a certain indication that the peritoneum, where it is being handled, is thoroughly anesthetized. The uterus and ovaries are not particularly sensitive when touched, but if the infundibulopelvic or broad ligament be pulled upon, pain is produced and is referred to the lateral pelvic wall. One of the most satisfactory regions to block is the perineum, including everything from the sacrum behind to the symphysis in front, and, for this purpose, the injection is made into the sacral canal. Harris uses novocain in his work and has found that the addition of calcium chloride in varying strengths enhances the effect of the novocain. His solution consists of novocain  $\frac{1}{4}$  to 1 per cent., calcium chloride  $\frac{1}{4}$  to  $\frac{1}{2}$  per cent., chlorbutanol  $\frac{8}{10}$  of 1 per cent. in distilled water, to which are added four or five drops of the 1 to 1000 adrenalin solution to 30 c.c. of the mixture. It is very essential that the solution be prepared properly and Harris goes into some detail in describing the preparation and method of storing the solution. As we have observed this method of anesthetization in the hands of the most expert advocates, we have never been convinced of its general value except in the rare case, in comparison with the well-given general anesthetic.

#### MISCELLANEOUS TOPICS.

**Bladder Function after Gynecological Operations.** In a series of 405 cases representing all varieties of gynecological operations studied by

<sup>1</sup> Deutsch. Ztschr. f. Chir., 1915, cxxxii, 381.

<sup>2</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 193.

Taussig,<sup>1</sup> 94, or 23.2 per cent., required catheterization after operation. The 311 women who urinated spontaneously voided on an average at the end of twelve hours, the shortest interval after operation being two and a half hours, and the longest was thirty-three hours. In comparing 30 cases requiring catheterization with 30 cases of spontaneous urination after the same time interval, Taussig obtained 395 ounces of urine in four hundred and sixty-three hours from the former class, as against 247 ounces in four hundred and sixty-six hours in the uncatheterized cases. In other words, an average of 13 ounces was obtained on catheterization, while only 8 ounces was voided by the average case, making approximately 5 ounces of retained urine in those women who voided late after operation. Clinically, there seem normally to be two types of bladders, a "large capacity" and a "small capacity" bladder, the latter being more sensitive than the former. It is interesting to note that only 2 out of the 34 small capacity bladders had to be catheterized (5 per cent.) whereas of the 17 large capacity cases, 9 (52 per cent.) were subjected to a catheterization one or more times. Not a single one of the large capacity series voided for the first time in less than ten hours. The interposition operation for prolapse and the radical operation for cancer of the cervix were particularly often followed by urine retention, which is to be expected. Anesthesia exerts some influence, as in a group of puerperal cases where no anesthesia was required, the interval before the first micturition was only about seven hours, whereas in the postoperative group the interval extended to twelve hours, and, further, ether has a more prolonged paralyzing effect on the bladder than spinal anesthesia.

The important factors in urine retention are interference with the blood supply of the bladder, direct or indirect pressure or irritation around the urethral sphincter, excision of the bladder nerve supply, and interference with the control of the central nervous system through anesthetics, drugs, or mental processes. The most difficult problem in urine retention is still the paralysis following the radical cancer operation, since in practically every instance catheterization is necessary here for a period of six days or more. The presence of large numbers of nerve ganglia in the parametrium removed at operation seems to explain urine retention in these cases on the basis of excision of the bladder innervation. In 31 such operations which Taussig has performed, only two patients were able to void spontaneously, and both of these were early cases without involvement of the parametrium, so that he now uses a retention catheter in these cases as a routine measure. In the milder cases of retention, there are several measures that may be tried in order to induce urination, such as getting the patient out of bed or using pituitrin, either alone or in combination with

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 416.

the preceding measure. Some mild vesical irritant injected into the bladder often causes this organ to empty itself, such as the boroglycerin solution suggested by Baisch in 1903. In searching for some mild vesical irritant that would be easy of application and that would not predispose to severe infections of the bladder, Taussig tried the effects of air injected into the full bladder, because on many occasions while using a Kelly cystoscope, he noticed pronounced bladder contractions as a result of the irritation of the bladder by the air that was admitted. He has used air injections in 11 cases with success in all but 1. If the patient has not voided for twelve hours after operation, and the usual methods of inducing urination have failed, two ounces of air are injected into the full bladder by means of an air-tight syringe. In cases in which the bladder seems very full, a few ounces of urine can be allowed to escape before injecting the air. This method has not as yet been tried in a prolapse or cancer case, and Taussig states that he would expect it to have absolutely no effect in the cancer cases, since in these cases, the trouble is in the innervation.

**Gynecological Operations on the Insane.** It will be recalled that a few years ago<sup>1</sup> we referred to the question of the relationship of insanity to gynecological lesions. This subject has again been brought into the limelight, this time by Gibson,<sup>2</sup> who divides insane patients into two classes with regard to their surgical possibilities:

1. Those in whom there is some form of dementia, such as dementia precox, general paresis, epilepsy, and senile dementia.

2. Forms of insanity in which dementia does not appear, as in manic depressive insanity, melancholia, and paranoia.

In Gibson's work no improvement from gynecological surgery was expected in the first class of patients, while some results was hoped for in the second class. There were 100 cases operated upon. Of these, 55 cases belonged in the first group and no mental improvement was noted in any of them. In the second group, there were 26 cases of manic depressive insanity of whom 13 were improved by surgery, there were 13 cases of paranoia of whom 1 was improved, and there were 5 cases of involution melancholia, of whom 2 were improved. The mortality in the entire series was 1 per cent. and this was due to a case of pontine hemorrhage. While the number of cases in this series is not large, the work is encouraging and leads one to believe that something might be gained by correcting pelvic conditions in women who have certain forms of insanity, especially those with manic depressive insanity. Gibson quotes Taussig's work, to which we have already referred, stating that there are three points indicating a relationship between gynecological disease and manic depressive insanity:

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1913, p. 289.

<sup>2</sup> New York Medical Journal, 1915, ci, 293.

1. The decidedly greater frequency of gynecological disease in this form of insanity.
2. The large proportion of cases of chronic pelvic inflammatory disease in this form of insanity.
3. The large proportion of mental recoveries after gynecological operations performed on women having this form of insanity.

Taking this series as a whole there was improvement in the mental condition in 17 per cent. of the cases, which corresponds fairly well with the reports of Mayo, Broun and Taussig whose reports collectively represent 319 cases.

**Glucose Solutions in Shock.** Of the three main groups of nutritives, fats, proteids and carbohydrates, only one, carbohydrate in the form of glucose solution, is available to the surgeon in the treatment of those accidents and disagreeable symptoms which may accompany or occur shortly after a major operation. The fact that patients are frequently underfed for a period of several days before an operation is often regarded as of little moment. A patient who is well nourished has enough food material stored in his tissues to supply his requirements for a short period; this is principally in the form of glycogen and amino acids, which are present in the liver and blood, and which may be called upon in sudden emergencies. Burnham<sup>1</sup> states that it is not sufficiently appreciated that after the first twenty-four hours these circulating and stored nutritives are exhausted, and after that time the body requirements are met almost wholly by the utilization of proteid and fat derived from the patient's own tissues. In the management of those diseases which are commonly classified as surgical, there are two conditions which are recognized as giving rise to acid intoxication or acidosis. The most common type is that following anesthesia, which occurs to an appreciable degree after from 30 to 60 per cent. of all anesthesias. The acidosis following starvation as it occurs in those diseases associated with the inability to retain nourishment because of persistent vomiting, is not uncommon among surgical patients, and, when it occurs, is considerably less amenable to treatment than the uncomplicated post-anesthetic acidosis. In the light of recent experiments, it is important that patients about to be subjected to major surgical operations should be put through a course of forced carbohydrate feeding for a short period immediately preceding the operation, and should receive carbohydrates in available form soon after operation. Sugar, in the form of glucose solutions, supplies energy to the tissues and aids in tissue repair; it diminishes acidosis and thus tends to remove one of the factors in the causation of postoperative vomiting; it neutralizes certain poisons in the circulation, and it is possible that it acts as a direct cardiac stimulant and food. Burnham cautions that solutions

<sup>1</sup> American Journal of Medical Sciences, 1915, cl, 431.

for intravenous or hypodermic use should be freshly prepared and sterilized, as they become more easily contaminated than does the ordinary saline solution. In addition to hypodermic administration, glucose may be given by proctoclysis during anesthesia and for a period of several days following anesthesia. For this purpose it is given in a 5 per cent. solution dissolved in ordinary tap water, 12 to 16 ounces being introduced during the operation, and its administration continued by the Murphy drip method after the patient has returned to the ward. This method is so simple and apparently of such value that Burnham believes that it should be done as a routine measure after every severe major operation.

**Treatment of Hemorrhage by Injection of Blood.** There is a surprising failure on the part of the profession to thoroughly utilize this means of treatment in the control of uterine hemorrhage. Those who believe that blood constitutes a valuable remedy in the control of hemorrhage, either advocate serum from the lower animals or tend to employ a needlessly elaborate technic when human subjects furnish the supply. Clinical results show that human blood is superior to the blood of lower animals in that it is less likely to be harmful to the patient and there is a much smaller danger of anaphylaxis. This method of treating hemorrhage is of special advantage in those cases in which the discovery or removal of the cause proves impossible, and in many ways it takes precedence over radium and therapy with filtered Röntgen rays, for these are obtainable only in a limited number of large hospitals and necessitates a considerable outlay of time and money, besides tending to cause atrophy of the ovaries. In view of the foregoing facts, Curtis<sup>1</sup> has elaborated a technic which is extremely simple and one which can be done by anyone and in almost any surroundings. A 20 c.c., or larger, ground glass syringe is sterilized, preferably by the dry method, and the inner surface lubricated with sterile petrolatum. Blood is withdrawn in the usual manner from a cubital vein of the donor; the needle is then inserted beneath the subcutaneous tissues of the back of the patient and the blood injected. The procedure not only has the advantages of simplicity and promptness, but does away with the likelihood of contamination during the transfer of the blood as in other methods where blood is collected into a glass vessel before injecting it into the patient. While this method may be of service in temporarily arresting hemorrhage, or may even produce a cure in some cases as Curtis suggests, I personally feel that we should not overlook the fact that in a certain number of the so-called idiopathic hemorrhages of the uterus, carcinoma of the fundus is the real underlying pathology and we should use every means at our command to determine the presence or absence of this condition instead of turning our attention to merely

<sup>1</sup> Journal of American Medical Association, 1915, lxiv, 332.

stopping the hemorrhage, since the cessation of the bleeding while under treatment, would give us a false sense of security and possibly allow a curable carcinoma to pass over the borderline of operability.

**Thrombosis and Embolism.** In his experimental work, McLean<sup>1</sup> found that when a vein is ligated in continuity, the blood in the vein will clot only on the side of the ligature from which the blood is coming. If a vein is ligated between two ligatures, the blood in this section clots very slowly and in a few weeks disappears, leaving a fibrous cord-like structure; the same condition will occur in an artery. If a vein be repeatedly crushed, a thickening of the coats of the vein will result, but the intima will remain as smooth and glistening as before, even the introduction of a culture of staphylococcus into the crushed vein will not produce a thrombus. If a thread, fixed at one end, be introduced into a vein, so that the other end plays free in the lumen, no thrombus will form provided that the thread is sterile; if, however, the thread is infected with staphylococcus, in three or four days a thrombosis will form at the site of introduction of the thread. This thrombus will not occlude the vein but will grow in the direction of the blood stream and remain attached at the point of entrance of the thread. McLean allowed sterile threads to float freely along in the blood stream and no symptoms occurred in seven weeks, but when he placed an infected thread inside of a vessel, death resulted in three and one-half days from pulmonary embolism. McLean's investigations along these lines have certainly been more or less of a blow to our older views concerning the formation of thrombi and emboli since he has shown that endothelial damage, on which so much stress is usually laid, is not *per se* a cause of thrombosis. Infection and necrosis or the toxins derived from an infectious or necrotic process are probably the most important factors in the production of a thrombus, while slowing of the blood stream must be regarded purely as a contributory cause in the etiology of thrombosis.

**Gall-stones Associated with Pelvic Disease.** Basing his statements on palpation of the gall-bladder in 1066 cases in which the primary incision was made for some pelvic lesion, Peterson<sup>2</sup> concludes that the gall-bladder should always be palpated when the abdomen is opened for pelvic disease except when contraindicated by the condition of the patient or the possibility of contaminating the peritoneum of the upper abdomen. Hence the small abdominal incision should give way to one large enough to permit of thorough exploration of the abdominal cavity. Peterson found gall-stones incident to pelvic disease in from 10 to 15 per cent. of the cases, their frequency depending more upon the age of the patient than upon the variety of the disease, the older the patient, the greater the possibility of her having gall-stones. Cholelithiasis is

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xx, 457.

<sup>2</sup> Ibid., 284.

much more common in women who have borne children than in nullipara, in this series 84.4 per cent. of the women who had gall-stones had borne children. If the gall-stones are removed at the time of the pelvic operation, 85 to 90 per cent. of the patients will have no further symptoms referable to the gall-bladder, but, if the stones are not removed, 30 per cent. of the patients will suffer subsequently from gall-stone attacks or other symptoms referable to the gall-bladder. Therefore, since gall-stones are always liable to produce symptoms and at times are a distinct menace to the patient, Peterson believes that they should be removed when the abdomen is opened for pelvic disease, if this can be done without much additional risk to the patient. My personal views on this subject are heartily in accord with those of Peterson. Not long ago we classified in detail all of the gall-stone cases which had been operated upon in our clinic at the University Hospital where it is our custom to remove either the stones or the gall-bladder in all of the cases showing pathology in the bile apparatus, providing, of course, as Peterson emphasizes, that the pelvic condition is not actively suppurative and the patient is in good condition. As a result of our investigation, which comprised extensive "follow up" work, we found that the additional risk of the upper abdominal operation was so slight as to be almost negligible, especially in cases where the gall-stones had never given rise to symptoms.

**Disinfection of Skin before Operation.** In recent years<sup>1</sup> iodine has enjoyed the reputation of being the most practical and efficient preparation for sterilizing the abdominal skin before operation. McDonald,<sup>2</sup> however, protests that of all the preparations generally used, not one gives the ideal results that we look for, since the ideal skin disinfectant should be a fat solvent. Alcohol, as generally used, is inefficient since the most powerful strength for disinfection is between 60 and 70 per cent., and above this strength alcohol loses its germicidal power. Bichloride of mercury, a most widely used substance, while a powerful germicide under test-tube conditions, is rendered inert by organic material, such as pus, serum, blood, soap and skin, because the insoluble albuminate of mercury is formed, after which there is no germicidal action. For disinfection of the hands of the surgeon, iodine solutions are impractical because of the irritation that they cause to the skin. Potassium permanganate, oxalic acid, and formalin are also rendered inert by organic material. Mechanical washing has but little effect upon the presence of bacteria on the hands; in McDonald's investigations, bacteria were always found upon the hands after five minutes of scrubbing with soap and water. The ideal skin disinfectant should perform its work quickly and without irritation and it must be a fat solvent in order that the fatty content of the skin may be dissolved

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1915, p. 296.

<sup>2</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 82.

away and the germicide penetrate into the interstices, hair follicles and sweat glands, since more bacteria are in the hair follicles than elsewhere. During a period of ten years, McDonald has tried many hundred solutions and germicides, and the most satisfactory one which he now uses has the following composition:

Acetone (commercial) . . . . .	40 parts
Denatured alcohol . . . . .	60 "
Pyxol . . . . .	2 "

This solution is cheap, does not irritate the skin, contains a fat solvent (acetone) and a strong germicide (pyxol). Pyxol is a dark liquid extracted from coal tar creosote, which forms a white emulsion with water and a light mahogany colored solution with acetone and alcohol. Its germicidal efficiency is twenty times that of phenol and its action is not impaired by the presence of organic matter. McDonald has used this solution for sterilization of the hands of the surgeons and the skin of the abdomen for more than a year with uniformly satisfactory results. It is applied for two minutes before the operation without any preliminary washing of the parts and it speedily evaporates, while the wound-healing, in the cases in which this technic is followed, is better than after any other method of skin sterilization. Besides the very enthusiastic reports which come from the originator of the solution, McMullen<sup>1</sup> and Stanton<sup>2</sup> state that they have given this solution a rather extensive trial and are very well satisfied with its powers as a germicide and its lack of irritating qualities.

<sup>1</sup> Surgery, Gynecology and Obstetrics, 1915, xxi, 87.

<sup>2</sup> Ibid., 1915, xxi, 89.

# DISEASES OF THE BLOOD. DIATHETIC AND METABOLIC DISEASES. DISEASES OF THE THYROID GLAND, SPLEEN, NUTRITION, AND THE LYMPHATIC SYSTEM.

By ALFRED STENGEL, M.D.

## THE BLOOD.

**The Blood Platelets.** A method for the differential study of blood platelets is described by Dimond,<sup>1</sup> and he believes that differential counts of these elements promise to be of the greatest utility in the diagnosis of various diseases. He submits the following rough classification of the various forms of platelets:

1. Platelet with central nuclear body, completely surrounded by protoplasm. The nucleus, which is round, oval, or irregular, may be eccentric. The protoplasmic mass is usually round, and possesses no processes.
2. Platelet with central nuclear body, surrounded by protoplasm, from which arise from one to seven or more flagella.
3. Fan platelets:
  - (a) To the nuclear body there is loosely attached a circular or semicircular mass of protoplasm.
  - (b) To the nuclear body are attached two fans.
  - (c) To the nuclear body are attached three or more fans.
4. Ring platelets:
  - (a) To the nuclear body is attached a single loop or ring of protoplasm.
  - (b) To the nuclear body two rings or loops are attached.
  - (c) To the nuclear body three or more rings are attached.
5. Combined fan and ring platelets:
  - (a) To the nuclear body one fan and one ring are attached.
  - (b) One fan and two rings are attached to nucleus.
  - (c) Two fans and one ring are attached to nucleus.
  - (d) Two rings or more, and two fans or more, are attached to the nuclear body.
6. Platelets with nuclear body alone, no protoplasm and no flagella. It is common for this type of platelet to have one or more of its corpuscles attached to the nucleus by means of a short stem like a drumstick.

<sup>1</sup> Jour. Path. and Bacteriol., London, April, 1915.

7. Platelets with nuclear body, and with one to seven or more flagella as the only representatives of the protoplasm.
8. Irregular and transitional forms of platelets.

Duke<sup>1</sup> has made a study of the behavior of the blood platelets in rabbits after the administration of small and large doses of various agents—namely, diphtheria toxin, benzol, the Röntgen ray, killed typhoid bacilli, and tuberculin. Each of these agents, when it had any marked influence on the platelet count, was found to increase the number of platelets when small doses were given, and to decrease their number when larger doses were given. Duke thinks it reasonable to conclude that these agents, in the smaller doses, acted as irritants to the platelet-forming organs, and in this way caused a rise in the platelet count. In larger doses they acted as poisons, or first as irritants and then as poisons, and caused thereby a fall in the count, or a rise followed by a fall.

The experimental data harmonize with observations on the platelet count in the clinical conditions thus far studied. For example, in a large number of counts made by the author in diphtheria, tuberculosis and nephritis, both increased and reduced counts were observed. A review of the literature shows that in most diseases in which the platelet count is profoundly altered, both increased and reduced counts have been observed. In the light of the foregoing experiments, the author believes that these clinical observations would not appear contradictory. It is believed that in almost every disease in which the number of platelets is markedly influenced by circulating toxins or poisons, the count may be either increased or reduced, according to the intensity and duration of their toxic action on the bone marrow. It must be added here that, as I mentioned in the text, the platelet count may be influenced also by other factors, such as altitude, hemorrhage, peptone poisoning, anaphylaxis, and also by some of the so-called diseases of the bone marrow.

One other important generalization the author thinks is possibly justified: In certain chronic diseases, tuberculosis and nephritis, for example, the count is increased as a rule and reduced in rare instances only. In other diseases, diphtheria, pneumonia, and typhoid fever, for example, the findings are diametrically opposite; that is, the count is reduced as a rule and increased in rare instances. It is believed that, in the former type of diseases (increased counts the rule), the platelet count is influenced by some mild irritant to the platelet-forming organs, such as killed typhoid bacilli or tuberculin, and that for this reason, an irritant effect is the rule, and a toxic effect, the result of an overwhelming dose, is not reached in the average case. In the latter type of disease (reduced counts the rule), the platelet count is believed to be

<sup>1</sup> Journal of American Medical Association, November 6, 1915.

influenced by some powerful irritant to the marrow, such as diphtheria toxin or benzol, so that the irritant dose is exceeded in the average case and a reduced count is the rule. The few cases showing an increased count are probably the milder ones in which the toxic dose is not reached.

**Erythrocytes.** Stockard<sup>1</sup> has conducted an investigation as to the origin of blood and vascular endothelium. His findings show that, in most embryos, the earliest blood formation occurs in the yolk and blood islands. The cells in these islands continue to divide until they become surrounded by endothelium, then the yolk-sac blood islands lose their hematopoietic function and become a vascular net through which the blood circulates. The liver now takes up the role of harboring dividing blood cells within its tissue spaces. When these spaces become vascularized by endothelium, the blood cells no longer multiply but merely circulate. Finally, in the mammalian embryo, one organ after another ceases to offer the necessary harbor for dividing blood cells, until the red bone marrow is the only tissue presenting the proper relationship of spaces and vessels, and here alone the erythropoietic function persists. The red blood corpuscles are always produced so as to be delivered into the vessels and thus soon occupy an intravascular position, while the white blood cells arise and remain for some time among the mesenchymal tissue cells in an extravascular position. Lymphocytes and leukocytes, along with the invertebrate amebocytes, are all generalized, more or less primitive, wandering cells and are almost universally distributed throughout the metazoa.

Erythrocytes are highly specialized cells with a peculiar oxygen-carrying function due to their hemoglobin content. In contrast to the universal distribution of the leukocytes, the erythrocytes are found only in the vertebrate phylum, except for a few cases existing in some of the higher invertebrate groups. Yet even in these particular cases, the oxygen-carrying blood cell never presents the typically uniform appearance of the vertebrate erythrocyte. The facts presented seem to indicate that vascular endothelium, erythrocytes and leukocytes, although all arise from mesenchyme, are really polyphyletic in origin; that is, each has a different mesenchymal fundament (anlage). To illustrate his meaning, Stockard refers to the origin of the liver and pancreas cells as a parallel case; both arise from the endoderm, but each is formed from a distinctly different endodermal fundament (anlage), and, if one of these two fundamenta (anlagen) be destroyed, the other is powerless to replace its product.

From experiments to determine the effect of muscular activity on the blood, Schneider and Havens<sup>2</sup> briefly picture the blood changes brought about through exercise. During muscular inaction, a large mass of the blood is diverted to the splanchnic area, where it probably stagnates and

<sup>1</sup> American Journal of Anatomy, September, 1915.

<sup>2</sup> American Journal of Physiology, 1915, xxxvi.

gives up plasma as lymph. There is also an accumulation of lymph throughout the remainder of the body, especially in the limbs. With the onset of muscular activity, the carbon dioxide content of the blood rises, this carbon dioxide stimulates the central nervous centres which regulate the secretion of the suprarenal glands, hence the output of adrenalin is increased. The adrenalin causing a constriction of the bloodvessels of the splanchnic area, forces the stagnant red corpuscles into the general circulation, thus giving the rise in specific gravity, hemoglobin, erythrocyte, and leukocyte content of the peripheral blood. Further, the contraction of the voluntary muscles accelerates the flow of lymph, throwing lymph rich in leukocytes into the blood. The increase in red corpuscles and hemoglobin makes it possible to supply more readily the greater demand for oxygen made by the active muscles. Shortly after the close of the exercise the carbon dioxide content of the blood falls below normal; as a result, the discharge of adrenalin becomes subnormal and the blood once more accumulates in the splanchnic area, so that there is a general return to the normal composition and even a temporary subnormal content in red corpuscles.

The results of Boothby and Berry's<sup>1</sup> experiments show that the percentage of hemoglobin and the number of red blood corpuscles, and therefore the oxygen-carrying capacity of a unit volume of blood, are increased under conditions of work causing an appreciable amount of perspiration. If no perspiration occurs, there is no such increase. These results seem to substantiate the theory suggested by Tornow that the increase in the number of red blood corpuscles, which he found in soldiers after long marches, was due to an increase in the density of the blood as a result of sweating. On account of the rise in the hemoglobin percentage, the oxygen-carrying capacity per unit volume of blood is proportionately increased. The authors regard this as an interesting example of the intercompensatory mechanism of the human body; it is evident that, in the main, the object of perspiration is to keep the body temperature down under conditions of work, yet its formation and elimination, by increasing the proportion of hemoglobin, increases the carrying capacity of a unit volume of blood thereby throwing less strain on the circulatory system.

Hill<sup>2</sup> has found that the *resistance of normal blood to hemolysis by hypotonic salt solution* is fairly constant. The figures for pernicious anemia and for secondary anemia are practically the same. In any given case of anemia, whether primary or secondary, the resistance may be high, normal or low. There is no such constant finding as there is in normal blood. In general, in both pernicious and secondary anemia, hemolysis is likely to begin sooner and end later than it does in normal blood. The hemoglobin content of the cell seems to bear no relation

<sup>1</sup> American Journal of Physiology, 1915, xxxvii.

<sup>2</sup> Archives of Internal Medicine, November, 1915.

to its resistance. Arsenic definitely increases the resistance of the red cells and tends to inhibit hemolysis. Splenectomy increases the maximal resistance, and it may decrease minimal resistance.

Roccavilla<sup>1</sup> has studied the *resistance of the blood corpuscles to different hemolytic agents*, including hypotonic sodium chloride solution, saponin and serum from the blood of certain animals in 62 patients having various diseases. He emphasizes that hemolysis may occur from a chemical reaction on the part of any one of the colloids in the corpuscles; also that the quality and force of the resistance offered by the red corpuscles, and the quality and force of the protection afforded the corpuscle by the plasma, must be taken into account in studying the blood. Test-tube experiments do not reproduce all these factors, and, hence, the findings in experiments in the laboratory do not apply entirely to clinical conditions.

Cook and Meyer<sup>2</sup> found that many of the red cells in a case cited by them, about one in three, on rough count, were elongated, oat-shaped or crescent-shaped, with the same color and structure as the normal red blood cells. Some of the crescent-shaped cells in the fresh drop would curl and bend as if they were unusually pliable. There was considerable variation in the size of the red cells and also many structures which seemed to be fragments of cells, as if some of the cells had been crushed. The rather uniform character of these fragments, however, suggests that they were not artifacts. Nucleated red cells were always present and at times were quite numerous. With Romanowsky stains there was only slight polychromatophilia. The red cells varied in number between 1,800,000 and 3,100,000, usually about 2,500,000; there was at all times a leukocytosis of mild degree; the color index averaged slightly below 1, and there was a constant eosinophilia at the expense of the polymorphonuclear cells.

Schnitter<sup>3</sup> and Lipp<sup>4</sup> have both reported the occurrence of basophilic granules in the erythrocytes of soldiers wounded by shrapnel, and in the erythrocytes of those in whom scraps of shells had been retained.

**Leukocytes.** Warfield<sup>5</sup> proposes a new classification of the white blood cells. In discussing the origin of the leukocytes, he dismisses the granular cells with the statement that polymorphonuclear neutrophils, eosinophils and basophils are derived from the parent myeloblasts, their immediate predecessors being the granular myelocytes of the bone marrow. The non-granular cells, namely: The large and small lymphocytes, transitionals, and large mononuclears have not the same origin and call for separate discussion. The lymphocytes have their origin in

<sup>1</sup> Riforma Medica, Naples, August 7, 1915.

<sup>2</sup> Archives of Internal Medicine, October, 1915.

<sup>3</sup> Münch. med. Wochenschr., February 23, 1915.

<sup>5</sup> Journal American Medical Association, April 17, 1915.

<sup>4</sup> Ibid.

lymphatic tissue. Normally, the particular lymphatic tissue is undoubtedly the lymph glands. They are classified usually in a percentage differential count as small and large. It is exceedingly doubtful if this be of any value. Opinion is growing that the small lymphocyte is the older form of the large lymphocyte. The picture in acute and chronic lymphatic leukemias would seem to indicate but one conclusion: the cells in the acute form are immature; those in the chronic form are mature, even to the point of degeneration.

There seems little doubt that these cells are derived from the same source, a parent lymphoblast in lymph tissue, although they show these differences in size and in staining reaction. The explanation seems to be the one given above, namely, that they are different ages of the cell. This is borne out by the fact that all gradations are seen, both of staining reaction, of size, and of amount of protoplasm.

So-called TRANSITIONAL CELLS (splenocytes, monocytes). These cells have been, and are even now, the rocks on which attempts at classification have split. They have been classed by some with "large lymphocytes," by others with "large mononuclears," by others as a separate group. In many specimens stained by Ehrlich's method, they are not seen because they are so very lightly stained as often to escape recognition. They have nothing to do with any transitional stage between any varieties of leukocytes. Ehrlich himself recognized his error in supposing that they were a transition between myelocytes and polymorphonuclears. Nevertheless, the name "transitional" sticks, and conveys a false impression in regard to the origin of these cells. These "transitional" cells are motile, with a slow, ameboid movement. This can be seen in the fresh smear, more easily when a warm stage is employed and when there is a marked increase in the number of these cells. Every pathologist must have seen, especially in the eosin-methylene blue preparations, large mononucleated cells partly in and partly out of the capillaries, showing evidently the ameboid character of these cells. The study of the cells in peritoneal exudation does not lead the author to believe that the large cells found there, arising most probably from the endothelium, are the same cells as those which apparently arise from the endothelium of the capillaries. As a matter of fact, these two kinds of endothelium present histologic differences. While both are of mesoblastic origin, one comes to be the lining membrane of the coelom, the other forms the lining of blood and lymph vessels. To the former, the name mesothelium is now given, while to the latter the term endothelium is limited. Cells derived from these two types of lining membrane differ. The blood cell is apparently derived only from the capillary or lymph space endothelium. In certain conditions, in response to infective agents, these cells occur in large numbers in lymph tissue and one is able to convince oneself of their endothelial origin. They are also very probably formed in large numbers in the capillaries and

lymph spaces in the spleen. It is in the lesions of typhoid fever particularly that one sees enormous numbers of them, many of which get into the blood stream, causing a considerable increase in the relative and actual numbers. In one case which ended fatally with hemorrhages, the author counted 46 per cent. of these cells and 48 per cent. of polymorphonuclear neutrophils. The lymphocytes were reduced to a very small percentage. Bunting has shown that "transitional" are the distinctive cells in early Hodgkin's disease. Hultgen and others have shown their importance in the early diagnosis of typhoid fever. The diagnosis of typhoid fever can be made in the very first days by a careful differential count at a time when the bacilli are not yet flooding the blood stream and long before the Widal reaction is positive. This cell is an important one, and should be recognized and properly classified in order to give it the value which it undoubtedly has in diagnosis.

LARGE MONONUCLEAR CELLS. There is still one other non-granular cell found in normal blood when stained with polychrome methylene blue stains. It corresponds to the cell known as Türek's irritation form. The origin of the cell is not certainly established. I have counted dozens of blood smears in typhoid fever without finding what I considered a plasma cell. I have never found more than 2 per cent. in a specimen other than leukemia. This cell stains so deeply, both in nucleus and protoplasm, that it has never been difficult to recognize it.

With this explanation of the origin of the cells of normal blood, the following classification is proposed by the author as a working basis. This presupposes that the stain used is one of the modifications of Romanowsky's stain. These stains bring out every cell in the blood, as well as the platelets, basophilic granulations, mast cells, etc. It is a classification which the author has employed for several years and found most helpful. There are three groups of non-granular cells:

1. *Lymphocytes* (mature and immature). These cells vary in size from a cell about the size of a red blood cell to that of a polymorphonuclear leukocyte.

2. *Endotheliocyte* (old name, "transitional"). This cell has no particular size or shape. It is the largest cell in the blood, and usually is considerably larger than the largest polymorphonuclear neutrophile. As it is ameboid, definite pseudopods are not infrequently seen which may give to the cells somewhat bizarre shapes. The staining is absolutely characteristic. The nucleus is large, stains a rather deep blue color, and has a spongy, openwork appearance. It never appears solid like the nucleus of the first group described above. A striking characteristic of the nucleus is its polymorphism. It may be of any conceivable shape or apparently be composed of several nuclei (megacarocyte?). Nuclei have been seen S-shaped, kidney-shaped, horseshoe-shaped, lobed, knobbed, ring-shaped or perfectly round—in short, any shape. In some cases with marked increase in this cell and increase

in number of platelets, almost bare nuclei are seen. The protoplasm is abundant, stains a much lighter blue, has a definite reticulated appearance and, at times, seems to be filled with fine deeper blue granules. Close examination reveals the fact that these are not true granules but are apparently the nodes of the cell reticulum. This pseudogranular appearance is common to all cells. These cells do not stain in a fixed picture pattern way in all smears from all bloods. Two smears side by side by means of the same technic will show minor differences in the color reactions of the cells. This should not be confusing. One should not expect every blood smear to look like the illustrations in text-books on hematology. One must glance over every stained smear in order to determine what the general tinting of the various types of cells is. With this precaution, there should never be any serious doubt as to the type of cell one encounters.

3. *Large Mononuclears.* This is a cell usually somewhat larger than a neutrophile leukocyte. The cell is almost always oval in shape. The nucleus is round or oval, almost invariably eccentrically placed in the cell. It stains a very deep blue and has a more solid appearance than the endotheliocyte, but not so solid as the small lymphocyte. The protoplasm is abundant and also stains a deep blue, almost as deep as the nucleus. Granular bodies are sometimes seen but these are evidently not true granules.

To give a name and a position to the endotheliocyte is in line with the importance of this cell in blood diagnosis. It is urged, therefore, on those working with stained smears that they adopt the proposed classification, always reserving the right to modify it or simplify it as knowledge of the origin of the white blood cells becomes fixed and definite. However, for the present at least, this classification, which is based on the best modern conceptions, will enable us to compare results with one another, a situation which has been hitherto absolutely impossible.

In connection with Warfield's classification, it is interesting to note the case of leukemia recorded by Reschad and Schilling<sup>1</sup> which they term a splenocyte or transitional leukemia coördinate with the lymphatic and myelogenous types. It is especially worthy of note that postmortem examination of this case showed large collections or masses of large mononuclear cells (splenocytes), with negative oxydase reaction spreading out from the bloodvessel walls into the surrounding fat tissue.

Mitchell<sup>2</sup> reports a study of the blood in which he analyzes 700 blood counts made on fifty children. From this study he is led to conclude that bottle-fed babies do not constantly show digestive leukocytosis; in fact, the majority show a smaller number of leukocytes in the superficial blood after taking food than before. This decrease is greatest

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1914, p. 346.

<sup>2</sup> American Journal of Diseases of Children, May, 1915.

at from one to two and a half hours after food, and tends to rise before the next feeding. When a rise does occur, it is most frequently soon after feeding, and begins to decline in a half hour. Crying, struggling and chilling of the part from which the blood is extracted, increases the count. Mitchell suggests that comparative counts be made at the same time of day, and at the same time in relation to the taking of food.

Photakis<sup>1</sup> calls attention to the importance to be attached to the appearance of immature leukocytes in the blood in infectious diseases. His conclusions are based upon the findings in 32 cases of various acute infections. Immature cell types were numerous in five-eighths of his cases, and these were all severe ones. This shows the toxic action of the infectious agent on the bone marrow, and so serves more or less as an index of the intensity of intoxication. Irritation of the bone marrow is first manifested by a neutrophile leukocytosis without immature forms. Then metamyelocytes appear. Then, along with them, appear myelocytes and promyelocytes showing the progressive phases of the irritation. In the very severe infections, especially with sepsis, all of the immature forms are met with down to myeloblasts, just as in the blood picture of leukemia. The staining of the internal structure of the nucleus is different in immature cells from that in ripe cells; amblychromatic in the immature forms and trachychromatic in the mature forms. By means of Pappenheim's staining technic one can differentiate the cells according to their age and maturity and thus estimate to a degree the severity of the infection.

Avoroff and Timofejevsky<sup>2</sup> have used Carrel's method in cultivating white blood corpuscles outside of the body. They found that the mononuclears of normal blood are able to proliferate karyokinetically, and that they become transformed into different shapes, such as hypertrophied, giant, and protoplasmic cells. The ability thus to undergo such changes in shape on the part of the mononuclears tends to confirm the theory of the active role they play in the healing and regeneration of tissues, with transformation into different forms, such as polyblasts and giant cells. The authors suggest that further light may be shed upon the origin of the eosinophile granules from such cultivation experiments.

Rubino<sup>3</sup> has studied the microchemical color reactions in the blood corpuscles when treated with some of the reagents used in tests for occult blood. Benzidin was found to be superior to guaiac for this purpose. The figured elements of the blood, treated with it, assume different colors, none like that of the benzidin solution itself, and hence he thinks we can regard them as true chemical color reactions. He analyzes the responses in the different types of cells and shows how they

<sup>1</sup> Deutsch. med. Wehnschr., October 28, 1915.

<sup>2</sup> Russkey Vrach, 1915, xiv, No. 24.

<sup>3</sup> Riforma Medica Naples, May 15, 1915.

correspond to the known laws of biology, and may serve in differential diagnosis. He applies the reagent to blood freshly drawn and allowed to evaporate in the air. The reagent is the ordinary 10 per cent. filtered aleoholic solution of benzidin to which is added, just before using, one drop of hydrogen dioxid for each 25 drops of the benzidin solution. The reagent thus prepared is poured on the stratum of blood and left in contact for three minutes. Then the reagent is washed off in alcohol and then in running water, and the specimen is mounted in neutral balsam.

In a study of the nucleus of the neutrophile polymorphonuclear leukocyte in health and disease, Cooke<sup>1</sup> has found that this nucleus, in normal blood, presents a sharply defined outline. It does not stain uniformly, but shows irregularities, due to the uneven distribution of the chromatin through the limin meshwork. Many of these depressions contain no chromatin at all. The nucleus in acute infections has a very different appearance. The outline is blurred or hazy, the mottled appearance of the normal nucleus is replaced by a densely and evenly staining mass of chromatin. In some, fine radiations of chromatin into the cytoplasm may be seen, or there may be coarser branches of the nuclear material jutting out into the cell body. In many cases, too, there is a distinct increase in the size of the nucleus as compared with the normal. In the majority of cases of acute infection, there is a leukocytosis. This also means an increase in the chromatin content of the blood. Cooke emphasizes the fact that nuclear activity must be looked upon as being evidence of the performance of very definite functions, the nature of which is determined by the immediate necessities of the organ of which that nucleus forms a part, therefore it is reasonable to suppose, considering the intimate connection that exists between the nuclear changes in the polymorph and the presence of bacterial toxins, that the polymorph plays an important part in the production of antibodies, necessary to successfully combat microbial invasion. The polymorph nucleus assumes, then, a prominent position in the production of active immunity. After many infections immunity remains long after antibodies have disappeared from the serum. Having seen the active part the polymorph takes in these diseases, it may be assumed that the continuance of the immunity depends on some faculty derived by previous education, existing in the polymorph or its parent cell.

Lowenthal<sup>2</sup> has for years been conducting a research on the behavior of the sciatic nerve in rabbits after resection. In the course of this research he observed the effects on the skin, lymph glands and blood and was impressed particularly with the marked eosinophilia which occurs as a result of this procedure in various organs that originally

<sup>1</sup> Journal of Pathology and Bacteriology, London, April 19, 1915.

<sup>2</sup> Rev. méd. de la Suisse romande, February, 1915.

do not contain eosinophiles. He found it possible to bring about their production in large numbers in remote organs merely by severing this nerve.

In the study of the process of phagocytosis as influenced by drugs, Hamburger<sup>1</sup> noted that minute quantities of calcium always augmented phagocytosis, suggesting the use of calcium in treating wounds. Iodoform has a similar influence, but iodin checks phagocytosis abruptly. Iodoform, and likewise chloroform and all other substances tested which dissolve fats and lipoid substances, have a pronounced accelerating influence on phagocytosis when in very dilute solutions. The results of recent research indicate that the outer layer of certain cells consists of a lipoid substance. As the drugs of this class, including chloroform and benzol, dissolve this lipoid coating, the ameboid movements are facilitated, and phagocytosis is thus promoted. When the drug in question is in a stronger solution, then it does more than merely dissolve the outer coating of the cell; it gets inside and acts on the body of the cell, paralyzing it, and hence all amebic movements cease, and phagocytosis is completely arrested.

Delbet and Karajanopoulo<sup>2</sup> have carried out experiments on dogs and *in vitro* to determine the enhancing power of certain drugs on phagocytosis. These experiments have met with confirmation in a few clinical experiences which demonstrate, according to the authors, the remarkable "cytophylactic power" of anhydrous magnesium chlorid in a 12.1 to 1000 solution. Before an intravenous injection into a dog of 150 c.c. of this solution, 245 microbes were found incorporated in 500 polynuclear leukocytes. After this injection, 681 were found incorporated among 500 polynuclears. In other tests the numbers phagocytized were respectively 71 and 308; 387 and 872. The effect seems more pronounced the more nearly normal the leukocytes. The solution does not seem to be toxic; no untoward by-effects were noticed in animals after injections into the cellular tissue, peritoneum or veins. In man they have never injected it into a vein, but have found it useful for dressing wounds and in subcutaneous injections. In one case of a suppurating wound after crushing of the knee, they were contemplating amputation, but the phagocytosis under the magnesium chloride improved conditions so that the limb was saved.

Kite and Wherry,<sup>3</sup> following observations on the adhesive character of the surface of certain amebæ and certain vertebrate leukocytes (Kite), undertook experiments which show that when separately incubated mixtures of leukocytes and serum, and serum and bacteria, are agitated together, many of the bacteria stick to the leukocytes and are rolled into their substance. That the bacteria are actually within the

<sup>1</sup> Nederlandsch Tijdschrift voor Geneeskunde, September 25, 1915.

<sup>2</sup> Bull. de l'Acad. de méd., September 7, 1915.

<sup>3</sup> Journal of Infectious Diseases, March 16, 1915.

cells is judged by observations on their digestion, as shown both in fresh and in stained preparations. By this method, several of the classical experiments on phagocytosis have been repeated. Experiments with a minimum amount of agitation show that here "phagocytosis" is reduced. Kite and Wherry offer the suggestion that foreign particles, as carbon, are taken up by leukocytes because the latter have sticky surfaces; that bodies similar to many bacteria stick to leukocytes best in the presence of unheated serum because they absorb something from the serum which makes them more sticky or are in some way rendered more sticky, and hence the chances of their adhering to the surfaces of leukocytes are increased. There is evidence that, even in the absence of serum, certain leukocytes are sticky enough to allow some bacteria to adhere. Preliminary experiments on the influence of temperature on the power of serum to make staphylococci sticky seem to indicate that this may occur as well at 11° C. as at 37° C., but that the action is diminished considerably at 1° C.

**Leukemias.** The literature of the past year on the leukemias has been relatively scant. The major portion has dealt with the etiology, and the tendency, the same as noted last year, is to connect these diseases with infectious processes.

**EXPERIMENTAL.** Schmeisser<sup>1</sup> has successfully transmitted myeloid leukemia into the fifth generation from a fowl in which the disease had been spontaneous. A total of 105 animals was used in conducting different kinds of experiments. Of this number, 22 in all developed leukemia. In 4 additional animals a definite diagnosis could not be established, although they were highly suggestive. The essential points deduced from the simple transmission of leukemia by injecting an organic emulsion may be stated as follows: After an incubation period, usually from five to six weeks, the fowl suddenly becomes pale, jaundiced, emaciates rapidly, loses weight, and shows signs of extreme weakness, followed, almost without exception, by death in one to two weeks. The total number of white cells is greatly increased, resulting in a proportion of one white to three red blood cells. The differential count shows a marked increase and predominance in the large mononuclears over the other white cells of the normal blood, which shows a decrease. Mononuclear myelocytes, with eosinophilic granules, are present in variable numbers in practically every case. Besides the normal large mononuclears, one sees many larger pale forms. In these cells typical and atypical mitoses in all stages are common. The total number of red blood cells is decreased and there is a marked fall in hemoglobin. The red cells present varieties in size, shape, and staining, associated with swelling of the nucleus. Normoblasts and megaloblasts, with mitosis in all stages, make their appearance. There is an increase

<sup>1</sup> Journal of Experimental Medicine, December, 1915.

in the number of blood platelets associated with an increase both in size of the cell and its nucleus. The cells frequently contain more than one nucleus. The clotting power of the blood is greatly decreased. A diffuse or focal infiltration of marrow cells occurs in many organs. The larger mononuclear cells and mononuclear myelocytes with eosinophilic granules predominate, and may occur separately or together in the same nodule. Extensive mitoses occur in both these cell types. This myelosis affects more particularly the liver, spleen, kidneys, and bone marrow, causing a great increase in the size of the first three organs. Rarely the cervical lymph glands are also very much enlarged. Most of the remaining organs and neighboring tissues may contain infiltrations, but not so extensive. The proportion of white to red blood cells is greatly increased in the blood vessels. The same cells predominate as in the infiltration. Atrophic and degenerative changes of the parenchyma and of the adipose tissue are marked.

From his study, the author concludes that the injection of an organic emulsion causes a picture of myeloid leukemia in every respect similar to spontaneous leukemia as it occurs in the fowl. The clinical picture and changes produced in blood and organs are analogous to those which occur in human leukemia. The spontaneous occurrence of myeloid leukemia of the fowl is confirmed. It may be transmitted by intravenous or intraperitoneal injection of an organic emulsion, and this is in confirmation of the work of Ellermann and Bang who first successfully transmitted the disease. They were followed by Hirschfeld and Jacoby. Successful transmissions, however, seemed to be limited to a strain which had its origin in a fowl presented to them by Ellermann and Bang. Burekhardt likewise transmitted the disease, but here again the stock animal came from Hirschfeld and Jacoby, therefore indirectly from Ellermann and Bang. The transmission reported here is of special interest because it originated in an animal absolutely unrelated to that of the previous investigators.

**ETIOLOGY.** It was noted last year<sup>1</sup> that Steele had isolated from lymph nodes, in cases of lymphatic leukemia, a diphtheroid bacillus similar to that described by Negri and Mieremet, Bunting and Yates, and Billings and Rosenow. Steele was enabled to define the relationship of this organism to the disease. A case has come under the observation of Simon and Judd<sup>2</sup> showing the characteristics of lymphatic leukemia, and, from the enlarged glands of this case, they were able to isolate corynebacterium lymphomatosis granulomatosæ.

The patient was a young man, aged twenty years. There was nothing of special note in his family or past personal history, beyond attacks of measles, shingles and smallpox, the latter a year ago. About six weeks previous to coming under observation, he first noticed a painful

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1915, p. 309.

<sup>2</sup> Journal of American Medical Association, May 15, 1915.

swelling in the right axilla, which the attending physician took for a beginning abscess, as it was red, swollen, throbbing and very painful. Soon after, other glands began to enlarge, beginning with those in the back of the neck. On December 1, left facial paralysis developed, the glands about the angle of the jaw being at that time much enlarged. At this time, examination of a blood smear revealed the true nature of the malady. On admission to Mercy Hospital, December 5, the following was noted: The patient's general condition was quite good, though he was somewhat pale (hemoglobin 60 per cent.). The most striking features at that time were his facial paralysis and the marked enlargement of all his peripheral lymph glands. This was especially striking in the upper half of the anterior cervical triangle and in the axillary regions, while the inguinal glands, though considerably enlarged, seemed relatively discrete. Physical examination suggested enlargement of the anterior mediastinal glands. Spleen and liver were within normal limits. Here and there on the lower portion of both legs there was a slight punctiform, macular rash.

During the interval between his admission and death, which occurred on December 12, there was no rise of temperature, excepting on three occasions, when it rose to 99.8°, 100.2° and 101°. There was a little nosebleed during the greater part of the time, and this, indeed, had been noticed off and on during two or three months preceding the onset of the glandular enlargement.

Death was due to an internal hemorrhage, which began on the day preceding and was temporarily stayed by a transfusion.

The urine showed no special abnormality until the day of death, when a trace of albumin, and a few hyaline casts and a most extensive deposit of colorless uric acid crystals were noted.

Blood examination in this case revealed the typical picture of lymphatic leukemia, with a large predominance of the ancestral form. Actual measurements on two occasions showed that only from 16 to 19 per cent. presented a diameter smaller than 8 microns, while in from 45 to 46 per cent., it varied between 8 and 10, and in from 35 to 37 per cent., between 10 and 15 microns. The structure of the nucleus in almost all the cells corresponded to that of the typical lymphoidocyte. Löwit bodies were noted in from 0.3 to 2.6 per cent. of the leukocytes, and mitoses were fairly common.

The Wassermann reaction was negative. Cultures from the blood remained sterile.

Within one hour after death, a group of enlarged glands was removed from the patient's right groin; fragments were planted on Löffler's blood serum, to which a small amount of hydrocele fluid had been added, and the entire surface was layered with white petroleum oil. No growth was observed until about the end of a week, when, in two of the four inoculated tubes, a small number of tiny silvery points appeared under

the coal oil layer which they first mistook for very fine air bubbles. After a few days, however, it became manifest that these tiny dots represented colonies of an organism, as they had increased in size and here and there coalesced. To secure as liberal a growth as possible the tubes were not disturbed until the expiration of a fortnight from the date of incubation, when smears were first prepared for microscopic examination. As stain, they used a combination of Jenner with Giemsa, followed by differentiation in water for fifteen minutes. In this manner, excellent pictures were obtained. Examined with a  $\frac{1}{2}$  oil-immersion lens, the organisms were found arranged in smaller and larger groups composed of individuals of variable size and appearance, but generally characterized by their content of deeply staining granules. When only two were present in an organism, and its body was but faintly stained, or altogether invisible, the impression of a diplococcus was conveyed, but a careful study showed that the organism was, after all, a bacillus with a variable number of granules.

Inoculation experiments with chickens, rabbits and guinea-pigs have thus far remained negative.

Histologic examination of one of the glands showed the typical picture of lymphatic leukemia; there was a generalized hyperplasia of the lymphocytic components of the gland with complete destruction of its normal configuration. Only at one or two points was there a suggestion of follicular remnants. The lymph sinuses and capillaries were filled with lymphocytes, and the perivascular connective tissue densely infiltrated with these cells. Giant cells and eosinophiles were nowhere to be seen.

To sum up, then, here is a patient presenting the clinical picture of lymphatic leukemia of the acute type, from whose glands the same organism evidently could be isolated, which appears to occur so constantly in Hodgkin's disease. Since Steele found an organism of the same order in another case of lymphatic leukemia, which likewise appears to have been of the acute type (judging from the clinical history), this can hardly be a coincidence, and naturally raises the interesting question of a possible relationship between the two diseases. Remembering the very different pathological pictures of the two, the existence of such a relationship at first sight seems difficult to realize, and at this stage of our knowledge it would indeed be idle to speculate on the possibilities which suggest themselves. Further observations in acute, as well as in chronic, lymphatic leukemia are demanded, and, most important of all, detailed inoculation experiments in monkeys.

Referring to the findings of Steele, and Simon and Judd, Bunting and Yates<sup>1</sup> report a case of chronic lymphatic leukemia of two years' duration, and a case of pseudoleukemia in which they were able to isolate from the enlarged glands of the former, and from the skin nodules

<sup>1</sup> Johns Hopkins Hospital Bulletin, November, 1915.

of the latter, the diphtheroid organism described by them as responsible for Hodgkin's disease. The authors say that the etiological relationship of this diphtheroid organism to the diseases must, perhaps, remain for a time *sub judice*. The occurrence of similar organisms in a variety of diseases would certainly seem to be an argument against their etiological importance. However, it is their experience, thus far, that this type of organism is found with readiness only in one general group of apparently related diseases, and in these, without fail, with good technic. In this group they include Hodgkin's disease, the lymphogenous leukemias, the pseudoleukemias (lymphosarcoma), Banti's disease, and probably also mycosis fungoides. Outside of this group, if the organism is found, there is also some histological evidence of its activity.

Wilbur<sup>1</sup> reports in detail three cases, one of the acute lymphatic type with mediastinal tumor, a practically normal blood count when first seen, and then with the clinical picture of an acute infection, rapidly increasing lymphocytosis, hemorrhage and death; another with similar mediastinal tumor but a more prolonged course, but so evidently an infection as to be confused with pulmonary tuberculosis; and a third with slow development, typical skin and other reactions, and with evidence of the involvement of the whole bone marrow, including the red blood-cell-forming portions. The bacteriological studies made of the last two cases were not at all conclusive, but were suggestive. In Case 3, streptococci were found in the blood thirty-three days before death. The early invasion of the bone marrow seems proved by the study of the blood, the changes in the white blood corpuscles, and the appearance of megaloblasts and normoblasts, together with the progressive anemia. The definite relationship of bone marrow infection to pernicious and other anemias and to the leukemias is certainly favored by a careful study of this patient. In infections it seems at times as if one part of the bone marrow responds, the red cell forming, and then in another white cell deviations occur; but here, toward the end, all parts of the bone marrow seemed involved. This is, of course, accompanied by more or less change in the spleen, lymphatic tissues, etc. It is true that while streptococci were found in the marrow after death, they were not so placed as to be clearly present in the lesions characteristic of leukemia. This may be a secondary infection with streptococci, but, clinically, the picture of a progressive bone marrow infection, with primary involvement of the white blood-cell-forming portions is difficult to lay aside. In Case 2 the streptococci are more evidently terminal invaders. The skin lesions in Case 3, with their surrounding hemorrhagic areas, certainly could readily be interpreted as metastatic processes, such as we commonly see in streptococci infections even of low virulence, and they speak for the infectious origin of the disease.

<sup>1</sup> Journal of American Medical Association, October 9, 1915.

The well-known wide range of activity shown by the streptococcus and its tendency to obtain and retain a foothold for long periods of years within the body in the endocardium, tonsils, bowels, about the teeth, and elsewhere, would indicate the strong probability that the bone marrow is often likewise infected, and that streptococci may retain a hold there and so induce the more chronic types of lesions associated with leukemia. In California, low-grade diplostreptococci infections are common, such as the characteristically mild rheumatic fever, erythema nodosum, probably erythema multiforme, bacterial endocarditis, at least some cases of hyperthyroidism, tonsillitis, intestinal lesions, etc. These, or tuberculosis, or both, may explain the fact that the lymphocyte count, as has been shown by Mehrrens, is apt to be high, at least in San Francisco.

These points, with others, lend color to the belief that the actual presence of streptococci in the bone marrow has a definite etiological part to play in the development of the leukemic picture observed. Only by further bacteriological, and, perhaps, protozoölogical studies of the blood, bone marrow, spleen and lymph glands of such patients, and by animal inoculation from the tissues involved, including bone marrow trephined from living bone, can we clarify this problem. If we can force the leukemias into the diseases of known origin, we have gone a long way toward the solution of a reasonable and effective therapy. Remedies damaging the bone marrow, such as benzol and chloroform, are now in common use, but they are dangerous and usually fail. We must not let the fact of chronicity in many cases divert our attention from the possibility that there is an active, even though mild, infection going on. Unfortunately, there is at present not sufficient evidence accumulated to give assurance as to the real cause of leukemia, but we feel justified in the following conclusions:

The evidence thus far available points somewhat suggestively to infection as the cause of the leukemia. It is probable that organisms, usually of low virulence but of various kinds, perhaps working on a soil prepared by previous infection, can, when they secure a foothold in the bone marrow, spleen or lymphatic glands, bring about the leukemic reaction alone or combined with disturbance of the red blood-cell-forming mechanism.

Streptococci have been more frequently reported than other organisms in the blood and tissue of the leukemic patients.

The attempt to classify rigidly the leukemias and pseudoleukemias, on purely morphological grounds, is futile.

A long series of bacteriological studies, including blood cultures and bone marrow inoculations from living patients, will be required to settle the relationship of infection to the leukemias as well as the anemias.

Foci of infection should be sought and treated. Only with the

establishment of the cause can we hope for a sound therapeusis of this condition.

Dias<sup>1</sup> reports 3 cases of myelogenous leukemia in which the white cell counts were 100,000, 244,000, and 648,000. From the venous blood and splenic punctures of these cases, he was able to obtain a bacilliform germ with pronounced polymorphism, which he calls the adenomyces leukemicæ. Laboratory animals inoculated with venous blood and products from splenic punctures and with splenic tissues from these cases developed progressive enlargement of the spleen and glands, with other signs of septicemia. After death, the pathological findings in the inoculated animals were all the same and were more pronounced the longer the interval after experimental inoculation.

Martelli<sup>2</sup> analyzes 12 cases of leukemic myelosis, 5 of leukemic lymphosis, 2 of leukanemia, and 5 of what he calls preleukemia. He inoculated laboratory animals with blood and tissues from these patients, but did not succeed in reproducing a condition like the original. The negative results of these inoculations, together with the fact that contagion is unknown, or that there is any focus where the disease is prevalent, speak against the assumption that there is a specific bacterial cause. In the study of his cases, he found that nearly all of them gave a history of some preceding infection, or that the patient was in a septicemic condition. Tuberculosis, syphilis, malaria, streptococcus, or staphylococcus infections, were known in most of the cases. There was likewise, in most of the cases, an evident predisposition manifested by adenoids, unstable nervous system, or defective development. An additional factor in some cases was a preceding trauma, or overfrequent pregnancies. Ordinary toxic infections occurring in the predisposed may lead to the changes characteristic of leukemia.

DIAGNOSIS. Evans<sup>3</sup> reports a method for the *application of the oxydase reaction to blood smears*, as follows: (1) Use blood smears as fresh as possible, and certainly not more than six weeks old. (2) Fix six to eight hours in the vapor of 4 per cent. formaldehyde solution in a closed jar. (3) Stain eight minutes in a saturated aqueous safranin, or a 2 per cent. aqueous pyronin, solution; wash, and dry immediately. (4) Examine the smear, and become familiar with the appearance of the various cell types with the nuclei thus stained. (5) (a) Put 1 drop of Solution 1 (less than three weeks old) and one drop of Solution 2 (less than four days old) on a slide, mount the smear in this and examine at once; or (b) mount the smear, film side upward, on a slide and put Solution 1 and 2 directly on the smear, watch the reaction, with the low power objective, progress to its height, and, at the end of two minutes, dry and examine with the high dry objective. Evans has

<sup>1</sup> Brazil-Medico, October 16 and 30, 1915.

<sup>2</sup> Riforma Medica, 1915, xxx, 47 and 48.

<sup>3</sup> Archives of Internal Medicine, December, 1915.

found this procedure convenient and reliable for demonstrating the presence or absence of oxydase granules in many varieties of white-blood cells, and, by reason of the differentiation between cells of myeloid and lymphoid origin made possible, it gives a preparation that is of great value in determining the status and origin of white blood cells of uncertain identity.

Hirschfeld and Dünner<sup>1</sup> report a case in detail which apparently was one of an acute septic infection, but which on complete study proved to be a *myeloblastic leukemia*. The patient was a shoemaker, aged twenty-nine years, who suddenly developed fever, chills and pains in the chest and abdomen. In the course of three weeks the symptoms practically subsided, but the headache persisted, and the patient ran a temperature of 39.4° C. and a pulse of 128. The leukocytes were 4000. There was no edema nor any enlargement of glands. Eventually, the gums began to bleed, and a necrotic patch developed. The blood count recorded 60 per cent. of hemoglobin (Sahli), 4,500,000 erythrocytes, and 400 leukocytes, of which 11 per cent. were polymorphonuclear neutrophiles, 6 per cent. large mononuclears and 83 per cent. of medium-sized, round, nucleated elements, which, on account of their nuclear structure, were assumed to be myeloblasts. The temperature rose while the blood cells dropped eventually to 1,700,000, and, within six weeks from the appearance of the first symptoms, the man died. Necropsy showed intense proliferation of myeloblasts, although they had not appeared in the circulating blood. No bacteria were found in the blood or the organs, not even in the necrotic patch on the gums.

Jackson and Smith<sup>2</sup> report an interesting case of lymphatic leukemia in acute infection after removal of the spleen in a young man, who, a few weeks after the removal of the organ in 1909, showed an essentially normal blood picture. In 1913, he developed what seemed clinically an acute tonsillar infection; this was quickly followed by marked enlargement of the glands of the neck and moderate general glandular enlargement, involving the axillary, inguinal, and epitrochlear groups. This situation was accompanied by a blood picture so typical of lymphatic leukemia that no other diagnosis seemed possible. After a week of sore throat, general malaise, and moderate elevation of temperature, the symptoms abated and a normal convalescence, as from an acute infection, ensued. Blood examinations made from time to time showed a gradual diminution in the white count and a change in the blood picture from that of a typical lymphatic leukemia on June 3, 1913, to an approximately normal picture on August 23, 1913, and a normal picture on April 15, 1914.

Ireland, Baetjer and Ruhräh<sup>3</sup> report a case interesting to consider

<sup>1</sup> Berl. klin. Wehnschr., January 4, 1915.

<sup>2</sup> Boston Medical and Surgical Journal, January 28, 1915.

<sup>3</sup> Journal of American Medical Association, September 11, 1915.

in connection with the case reported by Jackson. The important points to be noted were that the patient was a boy, aged ten years, who, following an attack of tonsillitis, had the tonsils removed on September 6, 1913, under chloroform anesthesia. For a month or more following this, his bowels were moved two or three times daily, and he had complained of almost constant pain in the abdomen. Following this, his nose had bled at frequent intervals. Upon examination, nodules about the size of a pigeon's egg were found under the chin and in the axillæ. Palpation revealed the presence of enlarged glands over all the body and some of them were slightly tender. The spleen was slightly enlarged; the entire abdomen was slightly tender on palpation, but was otherwise normal. Blood examination revealed a leukocytosis of 20,000; the differential count showed 2.5 per cent. polymorphonuclears; 67.5 per cent. large lymphocytes; 30 per cent. large mononuclears. The red-blood cells were 3,000,000; the hemoglobin 75 per cent.; Wassermann reaction was negative. The diagnosis of lymphatic leukemia was made, and treatment instituted consisting of the administration of the iodide of iron and increasing doses of Fowler's solution, in addition to which Röntgen-ray exposures were made for five minutes each day; this along with hygienic and dietary measures. No improvement having been noted on September 22, 1913, this treatment was discontinued<sup>1</sup> and 0.3 gram of neosalvarsan were given and this dose repeated on September 28 and October 21. At the time of the last injection, blood examinations showed a total white count of 16,000; the differential count showed 16 per cent. polymorphonuclears; 69 per cent. small lymphocytes; 15 per cent. large lymphocytes. Improvement was noted after this, and, on January 2, the blood revealed 12,000 leukocytes; 44 per cent. polymorphonuclears; 43 per cent. small lymphocytes; 12 per cent. large lymphocytes and 1 per cent. eosinophiles. The boy began to play with energy and looked well. The Röntgen ray was discontinued and Fowler's solution with iron was given for a period of two months. On June 28, 1915, the differential leukocyte count was 6; polymorphonuclears, 37.5; eosinophiles, 3.5; basophiles, 1; small lymphocytes, 37.7; large lymphocytes, 15; large mononuclears, 2.3; transitionals, 3. The red cells were normal, as were also the platelets.

Lawatschek<sup>1</sup> gives a detailed study of a case of lymphocytic aleukemia, with a blood picture of the aplastic type. On January 5, 1915, examination of the blood showed 2,400,000 red and only 1800 white corpuscles, with a hemoglobin content of 50 per cent. Smears showed marked anisocytosis. It was difficult to count 100 white cells in a preparation. The relation of the polymorphonuclear neutrophiles to the lymphocytes was 48 to 52. Eosinophiles and basophiles were entirely absent. Blood platelets were sparse. A definite polychromasia was

<sup>1</sup> Jahrb. f. Kinderh., April, 1915.

the only regeneration phenomenon noted. There were no normoblasts or myelocytes. On January 31, the blood showed the presence of 1,800,000 erythrocytes. The white blood cells were estimated at from 800 to 1000, hemoglobin 35 per cent. The relation of the white blood cells was about the same as in the first estimation. Resistance tests of the red cells gave no hemolysis. There was marked urobilinuria. On February 13, the Wassermann reaction proved negative. At this time a marked hemorrhagic diathesis set in, with bleeding from the gums, petechæ into the skin of the chest and intestinal hemorrhages. The patient died on February 17, 1915. The points of interest obtained from the postmortem examination were briefly: A hyperplasia of practically all of the lymphatic nodes. These lymph nodes, on microscopic examination, showed a diffuse small cell hyperplasia. The liver showed infiltration with small round cells. The kidneys, likewise, showed infiltration with the same form of cell. In the pulp of the spleen, these same cells were found. The bone marrow showed the typical marrow cells only in small islands which consisted principally of myeloblasts and nucleated red cells. In addition, there were large collections of the small round cells which occurred in the liver. In all of the organs examined there were numerous emboli of Gram-positive cocci in the small vessels.

**CHLOROMA.** Sakaguchi<sup>1</sup> reports in detail with postmortem findings a case of myeloid chloroma. This disease according to Lehndorff occurs usually in the earliest period of life. Among 70 cases which he assembled from the literature, 34 were under the age of fifteen years, and 21 occurred between the ages of fifteen and thirty. The author's case occurred at the age of forty-nine. The clinical symptoms were entirely those of acute leukemia. The swelling of the lymph glands and the increase in the size of the spleen, however, were not marked. The blood findings showed, as in most cases of myeloid chloroma, a great increase in the neutrophilic myelocytes, while the eosinophile cells, the mast cells and erythroblasts, were few. The nuclei of the myeloid cells were indented. With the progress of the disease, cell production was gradually reduced, while destruction of the leukocytes was increased. Tumor formations were noted on the ribs and in the periosteum of the vertebrae. Metastatic bodies were found only in the liver. Characteristic chloromatous changes were met with in the bone marrow, the lymph glands, as well as in the liver, spleen, and esophagus. In the other organs, no chloromatous changes could be demonstrated. The results of the urine examination were as follows: The quantity of urine and the excretion of total nitrogen, of ammonia and of phosphorus were distinctly, but not markedly, increased. The purin bases and the uric acid were not especially increased. Contrary to the statement of

<sup>1</sup> Mitteilungen a. d. med. Fakultät der k. Univ. Tokyo, 1915, xiii, No. 2.

Stiemons, the excretion of chlorides in this case was not decreased, and, in spite of a chloride-poor diet, this excretion remained at its normal height. The calcium and magnesium contents of the urine were, however, very small. From these urinary findings one can distinguish no difference between chloroma and acute leukemia. For the classification of the disease, it would be of the greatest interest to compare these findings with the chemical processes in sarcoma.

TREATMENT. *Experimental.* Weiskotten, Schwartz and Steensland<sup>1</sup> noted that, following the experimental subcutaneous administration of equal parts of olive oil and benzol in rabbits, there occurred a rapid decrease in the number of leukocytes in the peripheral circulation. Following this primary fall in the leukocyte curve there occurs a primary rise, which, in each instance, is followed by a secondary fall before a permanent rise to a normal level. The primary and secondary falls in the leukocyte curves are accompanied by a marked decrease in the percentage of polynuclear leukocytes, indicating that the polynuclear leukocytes are especially affected after the injections. Coincidentally with the primary fall in the leukocyte curve, there occurred, in two-thirds of the cases, a moderate, but definite, fall in the erythrocyte curve. The erythrocyte curve appears to progress independently of the leukocyte curve after the primary fall, and, in the majority of instances, remains unaffected during the secondary fall in the leukocytes. This fall in the erythrocyte curve was usually followed by a rise. In rabbits in which the injections were begun two days and six months respectively after splenectomy, the leukocyte and erythrocyte curves were essentially the same as in the non-splenectomized rabbits which received like injections, and the duration of the periods of regeneration was essentially the same. The differential counts on the non-splenectomized animals and those animals splenectomized two days and six months previously showed no essential differences, and the blood-cell picture was otherwise the same. The authors are of the opinion that these observations on the leukocyte and erythrocyte curves indicate that, in the rabbit, the spleen serves no essential function in the destruction of leukocytes and erythrocytes, following subcutaneous injections of the olive oil-benzol mixture, or in the subsequent regeneration of these elements. Any destructive or regenerative function that it has, is quickly assumed by some other part of the body when the spleen is removed. "Myeloid metaplasia" of the spleen is of no great importance as a compensatory phenomenon, and regeneration, as represented by the blood count, takes place at least as quickly in the absence of the spleen.

Neumann<sup>2</sup> has been able to find no substance to neutralize the toxic action of benzol. His experiments demonstrate the peculiarly variable action and effect of this drug, indicating wide differences in individual

<sup>1</sup> Journal of Medical Research, September, 1915.

<sup>2</sup> Deutsch. med. Wehnsehr., April 1, 1915.

tolerance. He concludes from this that it is extremely dangerous, since it is unquestionably a powerful poison for the leukocytes, and it is impossible to estimate beforehand the extent of its toxic action.

Stein<sup>1</sup> states that arsenic and benzol may improve the blood picture, but the "improvement" may be merely the result of the complete exhaustion of the blood-making apparatus. In one case of the latter kind, the leukocytes dropped under benzol from 225,000 to 9000, and the differential blood count became nearly normal. Stein published the case, in 1912, as an example of the efficacy of benzol treatment. The patient was a woman, aged sixty-eight years, with myeloid leukemia. She was further treated with arsenic, and regained her earning capacity. The whites continued to decrease until they numbered only 2000, but the reds increased. This transition into a subleukemic phase and the consequent marked general improvement kept up for eight months. The woman then died of intercurrent pneumonia. The effect of benzol treatment was equally marked in the case of a woman, aged thirty-eight years, but it was a sham improvement. The aleukemic blood picture was only simulated, the drop in the leukocyte count being produced by a total breakdown of the blood-producing apparatus, with mental disturbance, hemorrhagic diathesis, and, finally, not a trace of coagulation in the blood. Necropsy in the first case disclosed the typical picture of myeloid leukemia, but in the second no signs of leukemia were found, merely those of retrogressive changes in the blood-producing apparatus, atrophy and destruction—the effect of the toxic action of the benzol. The woman continued the benzol after the prescribed course, taking it for five weeks without medical oversight. The importance of differentiating between these two types of benzol action is obvious.

Reports on the use of benzol in leukemia during the past year have not been very numerous. There have been favorable, as well as unfavorable, results from the use of this drug. There seems to be no exact opinion as to its status in our therapy of leukemia. Benzol, however, is practically the only mode of therapy which receives any considerable attention in the literature of the past year.

Petty<sup>2</sup> cites a case of myelogenous leukemia previously treated by arsenic and the *x*-ray, and finally put on benzol in increasing doses. In a month's time the patient was getting 35 drops three times a day. The blood picture had improved, and the patient had increased in weight and felt much better. From this time on there were daily fluctuations in the blood picture, the red cells and hemoglobin steadily increasing, the whites growing less and the urine remaining normal. If the benzol were reduced to 10 or 15 drops at a dose for a few days, the white cells rapidly increased in number, so the dose was left at 35 drops thrice daily for nearly three months, when the blood count showed

<sup>1</sup> Med. Klinik, March 7, 1915.

<sup>2</sup> New York Medical Journal, June 26, 1915.

85 per cent. of hemoglobin, 4,800,000 red cells, and 8600 leukocytes. No myelocytes could be found. A discoloration of the skin had disappeared, and the spleen could not be palpated. The patient weighed 189 pounds, and said he never felt better in his life. It is too early to draw any conclusions from this case, but the course, so far, has certainly been favorable.

Boardman<sup>1</sup> considers the principle of treatment by benzol to be a sound one. He believes that, with proper precautions, there is no appreciable danger in using benzol. The improvement is real and not due to the accumulation of the leukocytes in the central vessels. The improvement is only temporary, as in other methods of treatment. The treatment is applicable in all chronic cases of leukemia. Bronchitis and anemia cannot be considered contra-indications. The presence of nephritis is a more serious complication, and demands more careful consideration. The treatment is more readily administered and is less costly than the Röntgen ray and may be given to those unable to obtain the Röntgen ray. The percentage of improvements is about the same under benzol as under the Röntgen ray.

The drug is best administered in freshly filled, gelatin capsules, with an equal amount of olive oil; the maximum daily dose not to exceed 5 grams. The treatment must be carefully controlled by frequent blood and urine examinations, and discontinued if there is evidence of kidney irritation, or when the leukocytes reach values of 25,000 to 20,000. The best results follow the combined benzol and Röntgen-ray treatment, the benzol effect apparently being increased by a preliminary Röntgen-ray treatment. Some cases will not respond to benzol in the usual dosage and in the usual time, and other patients are unable to take the drug owing to gastro-intestinal disturbances, etc. When carefully administered, and carefully controlled, benzene is apparently a valuable addition to the methods of treating chronic leukemia.

Meyers<sup>2</sup> cited a case of lymphatic leukemia in which there was a gradual reduction of the white blood cells with comparatively small doses of benzol, with a complete reversal of the picture of the white blood cells as it appears in cases of leukemia not treated with benzol. With the exception of the blood picture, there were no other signs of benzol poisoning. Apparently good results were obtained while the patient was receiving benzol, 3 minims, four times daily.

A case of chronic lymphatic leukemia is reported by Rolleston and Rolleston<sup>3</sup> in which benzol therapy proved temporarily beneficial. The case occurred in a boy, aged six and a half years, and the disease had evidently been in existence for at least eight months when the case came under observation. On December 29, 1913, benzol was first

<sup>1</sup> California State Journal of Medicine, September, 1915.

<sup>2</sup> Arch. Pediat., New York, March, 1915, xxxii, 3.

<sup>3</sup> Brit. Jour. Child. Dis., February, 1915.

administered in an initial dose of 6 minims *per diem*. On January 10, 1914, this dosage was increased to 12 minims *per diem*; on January 25, to 15 minims *per diem*, and this last dosage continued until February 12, when the benzol was stopped altogether. There was progressive diminution in the leukocyte count during the treatment, and the patient's general condition was greatly improved. Lassitude and weakness disappeared, the appetite improved, and the edema of the head, which was present, passed away. The spleen, however, remained practically unchanged in size. The glandular enlargement did not become less, and the patient did not put on weight satisfactorily. Leukocyte counts taken weekly revealed at one time a count as low as 2900, whereas in the beginning the leukocytes were 60,000. On March 4, the patient appeared to be extremely well, and was transferred to the convalescent home. On April 2, he was readmitted to the hospital, the glands being distinctly harder and somewhat larger. The general condition was decidedly worse, and he was exceedingly languid and suffered from dyspnea. The total leukocyte count was 123,000, small lymphocytes being the predominant cell. Benzol, 9 minims *per diem* was given, and in ten days the count had fallen to 15,000. This decrease was accompanied by improvement in the general condition. On April 16 the benzol was again omitted, and on April 20 the leukocytes were found to be 20,000, while on April 30, they were 29,400. On May 11 the child was again put on benzol, 20 minims *per diem*, but later in the day the temperature suddenly rose to 101.2° F., the face became edematous, a purpuric rash was evident on the right cheek, and there was an offensive nasal discharge. Throat cultures showed the presence of numerous diphtheria bacilli. He was then transferred to another hospital and given 15,000 units of antidiphtheritic serum. The child passed into a septicemic state and died on May 20. An examination of the blood, on May 14 and 15, showed a well-marked leukopenia; 1400 on the former day, and 1600 on the latter day.

Graham<sup>1</sup> gives the results of treatment with benzol in a case of severe splenomeyelogenous leukemia. The patient, a woman, nearly expired during the journey to the hospital where she was admitted June 3, 1914. The blood count on the day after admission revealed 2,610,000 red cells, hemoglobin 60 per cent., and 270,000 white cells. The differential count revealed 22 per cent., polymorphoneutrophiles; 1.2 per cent. polymorphonuclear eosinophiles; 1.2 per cent. small mononuclears; 0.4 per cent. large mononuclears; 73.2 per cent. neutrophilic myelocytes; 0.8 per cent. basophilic myelocytes; 1.2 per cent. eosinophilic myelocytes. Treatment with benzol was immediately started, the initial dose being 15 minims *per diem*; later this was increased to 45 minims *per diem*. Shortly after the institution of treatment, improvement

<sup>1</sup> Journal of American Medical Association, February 6, 1915.

began, both in the blood picture and in the patient's general health. This improvement continued until July 24, when her temperature abruptly rose, and, on July 27, she complained of pain in the left side. An area of extreme tenderness was discovered over the enlarged spleen, probably corresponding to a fresh infarct. The red cell count had already fallen a little, and the white cell count had risen. From this time on, her failure was rapid. July 30, the red count had fallen to 2,000,000, and the benzol was discontinued. Recourse was had to the Röntgen rays, but the patient developed signs of acute leukemia and within thirteen days of the withdrawal of the benzol, she died with a white count of 456,000.

Smith<sup>1</sup> discusses the results of treatment with benzol in a case of myelogenous leukemia which he reported last year.<sup>2</sup> At the time of the present report, the case had been under observation and treatment for a period of nineteen months. The author says that when it is recalled that the patient under consideration was a boy, aged thirteen years when treatment was started; that the spleen then occupied about four-fifths of the abdominal cavity, and that the leukocytes numbered 499,000, one is justified in expressing surprise that he is still alive. That the result is due to benzol, cannot be reasonably questioned. The effectual range of dosage had been fixed in this case; only once was a dose of 25 drops three times a day exceeded. The results have followed a dosage of from 20 to 25 drops three times a day. The author thinks that any less dose would seem worse than useless, as this case, in one of its phases, suggested that the leukopoietic system becomes immune in time to a dose that was leukotoxic perhaps but a short time before. If such a conclusion be true, then the smaller than effective dose may, in course of time, become actually stimulating to leukocytic generation. Larger doses had not been necessary, and with all potent drugs one should desire to keep the dosage within the limits of potency on the one hand, and of safety on the other. In concluding his discussion, Smith says: "In doubting its specific properties I admit a great disappointment. I had hoped that one more of the number of incurable diseases was soon to give way before specific therapy. Instead of this hope, I am confidently looking forward to the time when, in spite of, if not because of, benzol, this patient's leukemia will assume one of three forms: A chronic progression upward of the leukocyte curve, a constant enlargement of the spleen, and ultimate death, just as if there had been no staying treatment, or an acute fulminant picture, in which the increase of the leukocytes will be by leaps and bounds to a high figure; or, on the other hand, a drop in the leukocyte curve will come, will not stop at the normal line, but will continue downward to 500 or thereabouts, with all the other evidences of aplastic anemia."

<sup>1</sup> Journal of American Medical Association, May 22, 1915.

<sup>2</sup> See PROGRESSIVE MEDICINE, June, 1915, p. 322.

When all is said, however, concerning the disappointment in train of this experience, and of the dangers that lurk in its unguarded and largely empiric use, the chemical has a most remarkable inhibiting influence on the course of the disease. There is no exact analogy that I can think of. Like digitalis, however, benzol may have a distinct place in therapy, even if its action proves short of specific, and merely symptomatic, staying or inhibitory."

**Hodgkin's Disease.** The literature on this subject has been quite limited, and has dealt principally with the assumption that this disease is the expression of an infectious process. In the past we have discussed the findings of Fränkel and Much, Negri and Meiremet, Bunting and Yates, Billings and Rosenow, Steele, and Qusunoki, all of whom have succeeded in isolating, from the lymph glands of Hodgkin's disease, an organism of rather varied morphology which might be considered a member of the diphtheroid group.

Yates and Bunting,<sup>1</sup> in a discussion of Hodgkin's disease and allied affections, state that, as a result of their studies, a working hypothesis has been developed upon the assumption that Hodgkin's disease is a non-communicable, infectious, granulomatous process due to the *Bacillus hodgkini*, protean in its clinical manifestations. Pathologically, four fairly distinct stages occur in the development of the latest known lesion, not all of which have been found in any one case. The tenability of the working hypothesis already stated is directly dependent upon the existence of these stages. It is quite illogical to assume that but one lesion occurs, and this without earlier or later developmental or individual variation.

The first stage comprising early pre-characteristic lesions consists of the usual tissue response, exudation and deposition of fibrin, and an accumulation of neutrophiles with occasionally the occurrence of plasma cells in considerable number.

In the second stage, comprising early characteristic lesions, possibly after a matter of two or three weeks, there is a moderately advanced diffuse fibrosis, with a consequent obliteration of the normal architecture of the affected glandular tissue.

In stage three, comprising late characteristic lesions, the fibrosis has become extensive, with consequent diminution in the number of cells present, the lymphocytes being conspicuously fewer.

In stage four, comprising terminal characteristic lesions, the changes are seldom observed because death commonly occurs before they develop. The fibrosis is very advanced; the gland is almost entirely converted into scar tissue, between the fibers of which occur a few cells more of the endothelioid type than of the lymphocytic type.

Clinically, their studies would indicate the possibility of a tentative

<sup>1</sup> Wisconsin Medical Journal, August, 1915.

classification of these infections into four groups based upon differences in the strains of organisms obtained as well as upon consequent tissue reactions, but all possessing certain common features, *viz.*, alternating periods of progression and regression, three fairly distinct stages, quite constant variations in the leukocytes, progressive secondary anemia and a fatal termination.

Group 1. Typical glandular variety wherever primary, cervical, inguinal, axillary, mediastinal or abdominal.

Group 2. Atypical glandular variety, simulating lymphosarcoma. Three cases have been studied from two of which cultures were obtained, the third was confined to a tonsillar tumor. These observations are confirmed by Dr. Graham in his study of a case at Lakeside Hospital, Cleveland.

Group 3. Atypical glandular variety simulating lymphocytic leukemia, if not identical therewith.

Group 4. Atypical glandular variety, associated with tuberculous adenitis.

Lamford<sup>1</sup> has succeeded in isolating diphtheroid organisms from the glands in 4 cases of Hodgkin's disease. The author says that the description of these organisms by various writers shows that they are similar in each case, and indicates that the glands of Hodgkin's disease very frequently, if not always, are the focus of bacterial growth. The author carried out some experimental work with the organisms obtained from a Hodgkin's case by inoculating guinea-pigs in the axillary spaces and studying the lesions over various periods. While a marked inflammatory reaction was present in every instance in the surrounding adipose tissue, in no instance had any change been produced in the lymph gland which suggested Hodgkin's disease. The course of this affection, with gradual involvement of the lymph structures of the body, with secondary growth elsewhere, resulting in a marked anemia and finally ending in death, leads one to believe more in the neoplastic origin of the condition than in the inflammatory or infectious origin.

From the studies of Bloomfield,<sup>2</sup> it is clear, even with his small series of gland cultures, that the findings vary in significance in different cases. In view of the variety of organisms found, it seems that extreme conservatism should be maintained in interpreting any one as the etiological agent of a specific disease. From his work the following conclusions may perhaps be drawn. Organisms can frequently be cultivated *intra vitam* from the lymphatic glands. There is a higher proportion of successful cultures from definitely diseased glands than from those approaching a normal condition. Saprophytic organisms, identical with, or closely allied to, the surface flora of the body, are frequently filtered out or perhaps constitute a more or less permanent

<sup>1</sup> New Orleans Medical and Surgical Journal, June, 1915.

<sup>2</sup> Archives of Internal Medicine, August 15, 1915.

flora of lymph glands. Organisms are frequently isolated which seem by their biological characteristics to be suited to live in relatively avascular areas, and which may tend to invade diseased glands, although they are not limited to them. None of the twenty-nine strains isolated in the author's series could be shown to be the cause of specific diseases.

From an exhaustive study of a series of 25 cases of Hodgkin's disease, Cunningham<sup>1</sup> is led to think that the Dorothy Reed type of Hodgkin's is not a type but the classical picture. It stands as a distinct entity. The prognosis of Hodgkin's disease is difficult. The treatment he advocates is excision of all foci of infection, and the use of the Röntgen rays. He believes vaccines to be valueless. In order to make a diagnosis in lymphatic disturbances, the author says that more than one gland should be obtained. He gives the following evidence to support the assumption that the disease is an infection, bacterial or protozoön in origin: (a) The histology is that of an inflammatory reaction; (b) injections of gland emulsions have caused temporary lymphatic enlargement in lower animals (literature); (c) the fever resembles closely that of other infections; (d) the occurrence of leukocytosis; (e) the exudate which is present when serous surfaces are involved. The specific organism, according to the author, has not been isolated, and later he will make a detailed report to support this view.

TREATMENT. In a paper on the therapy of Hodgkin's disease, Yates and Bunting<sup>2</sup> describe the measures advocated by them under six headings:

1. Removal of the source of infection. (a) Where involvement is primarily cervical, complete pericapsular tonsillectomy should be performed, and the teeth, nose, ears, eyes and accessory structures must be excluded as a site of primary infection.
- (b) If the primary glandular involvement be extracervical, a search must be made for the source of infection in the area indicated.
2. Extirpation of the major portion of the disease, through the excision of all the glands involved, by extensive and widespread dissection followed by an application of the principles of antisepsis through the use of the tincture of iodine in the operative area. The wound area should be exposed to the Röntgen ray not later than forty-eight hours after the operation, and preferably after a few hours.
3. Destruction of the bacteria by the Röntgen ray. No permanent cure has been obtained solely by the use of these rays, but, from experiments quoted, they are probably of value in destroying bacteria.
4. Hygiene, along with the use of tonics and arsenic.
5. Vaccines. Improvement has followed subcutaneous injections of both polyvalent stock vaccines and the autogenous, but not in every case, and in some, at least, the same old discouraging sequence of

<sup>1</sup> American Journal of Medical Sciences, December, 1915.

<sup>2</sup> Journal of American Medical Association, June 12, 1915.

events ensues followed by recrudescence and death. The author's experience has shown that vaccines have exerted no marked, if any influence on the ultimate course of the disease.

6. The conversion of abnormal tissue into fibrous tissue. The best possible physical condition and Röntgen rays are the only methods that have been supposed to aid this transformation. They also consider and discuss supplementary treatment and re-excisions.

In a discussion of results, a cure or, better, a recovery can be considered as established only when there is no trace of the disease, including a normal blood picture, at least five years after the last manifestation of the infection. Recrudescence has occurred after a shorter period of apparent freedom. A case recorded by Eve had an interval of six years between a primary operation and the first recurrence but the diagnosis was not established.

Hatcher and Lemmon<sup>1</sup> have had what they look upon as a favorable result in the treatment of a case of Hodgkin's disease by the use of vaccines. The initial dose was 25,000,000, and this was gradually increased to 2,000,000,000, while, in addition, Röntgen-ray treatment was given every five days for eight weeks. About two months after treatment was begun, and while the disease appeared to be ameliorating, the patient was taken with acute suppurative appendicitis. After ten day's time he was operated upon and the abscess drained. During this time there was an extremely rapid decrease in the size of the glands, while with the cessation of pus, there was a corresponding slackening in the retrogression of the glands which did not cease entirely but has continued until the present. Constitutionally, the patient feels perfectly well and is at work. The authors wonder what influence the infectious process may have had on the healing process, but the general course of the disease, after the vaccine treatment was begun, leads them to think that while the appendicitis may have had a favoring influence, the main results were due to the vaccine.

Fox<sup>2</sup> has made a careful bacteriological study of 13 cases, including 4 of Hodgkin's disease, 1 of sarcoma of the lymph glands, 1 of endothelioma of the lymph channels, 2 of tuberculosis of the lymph glands and 5 of arthritis. From this work he concludes that diphtheroid rods may be isolated from Hodgkin's disease and other adenopathies, but there is no uniformity in biology and morphology among the strains isolated by three observers from clinical and pathological Hodgkin's disease. Diphtheroid nodes, similar in biology and morphology to those found in Hodgkin's disease, may be found in enlarged glands in cases of chronic atrophic arthritis and other conditions.

Diphtheroids have been found in glands which are the seat of a neoplasm, and in the enlarged glands near a neoplasm. There is great

<sup>1</sup> Journal of American Medical Association, October 16, 1915.

<sup>2</sup> Archives of Internal Medicine, September, 1915.

similarity in all respects between the gland diphtheroids and those found in normal and pathological seats in the body, the so-called pseudodiphtheria bacilli. More facts are demanded to show the exact relation of the diphtheroids to Hodgkin's disease.

In one case in which autogenous vaccination was given a fair trial, the patient died.

Another patient, already improving under the Röntgen ray, continued to improve with autogenous vaccination and no Röntgen ray. In arthritis cases, the patients receiving vaccine consisting wholly or in part of diphtheroids, showed some improvement.

Much granules have not been found in sections of lymph granulomas of the Hodgkin's type.

Mellon<sup>1</sup> has made a study of the cultural and vaccine results in a case of Hodgkin's disease occurring in a male, aged fifty-seven years. In this case the author was unable to see any good results whatever that could possibly be traced to the use of an autogenous vaccine, although the dosage did not go above 150,000,000. Excepting a few transitory improvements which might be attributed to the Röntgen ray, the downward course of the case was a rapid and uninterrupted one from May 8 until July 13, and the patient's demise six weeks later would seem to conform to the previous rapidity with which the disease progressed. The author states that the removal of the gland by surgical operation caused a rapid enlargement of the neighboring glands. He hopes that this case may have been atypical and that the general run of cases may yield to treatment.

Hoffmann<sup>2</sup> describes a typical case of lymphogranulomatosis with characteristic changes in the glands, granulomatous infiltrations of the skin and the occurrence of a pemphigus-like exanthem. The toxic nature of this eruption was rendered probable through the histological findings, and by the increase of the eruption during the period of rapid resorption of the gland tumors through the use of the *x*-ray. With deep radiation, using hard Röntgen light (20 X with 2 mm. aluminum filter), the gland tumors and skin infiltration disappeared very quickly, but in four weeks' time there was a recurrence of a milder grade. Signs of tuberculosis in the patient could not be found. Animal inoculations up to the present have been negative, and acid-fast or Gram-positive rods or Much granules could not be found. However, Gram-positive cocci were found whose significance has not been made clear. Histologically, the glands and skin nodes revealed the typical picture of lymphogranulomatosis, as described by Sternberg. Especially remarkable is the origin of the eruption through mechanical injury and through the local irritation of the Röntgen ray. After the mild recurrence, a second course of the Röntgen ray was followed by improvement. The

<sup>1</sup> American Journal of Medical Sciences, August, 1915.

<sup>2</sup> Deutsch. med. Wochenschr., September 16, 1915.

patient now, four months after he was first seen, feels quite well, and the glands are all normal in aspect, except for slight enlargement of some in the neck and axillæ. A second case treated by Hoffmann also showed a prompt response to the use of the *x-ray*.

**Pernicious Anemia.**—Pernicious anemia has had a fair share of attention in the literature of the past year. A large portion of the writings concern the relationship of this disease to the spleen, and this principally through the discussion of splenectomy as a therapeutic measure.

**PATHOLOGY.** A study of the *factors of coagulation* in a number of cases of different diseases including 7 cases of pernicious anemia has been made by Drinker and Hurwitz.<sup>1</sup> Their findings in pernicious anemia were as follows: (1) prothrombin is diminished slightly in all cases of pernicious anemia; (2) this diminution is not great and is unimportant if active regeneration is in progress; (3) antithrombin and fibrinogen are normal, even in the presence of very low cell counts; (4) in one case in which there had been pronounced diminution in prothrombin, platelet counts have been strikingly low, and the picture throughout has been that of fairly complete aplasia.

Robertson<sup>2</sup> has investigated 13 cases of pernicious anemia with the idea of determining the *effect of splenectomy, transfusion, and salvarsan*, as therapeutic measures, and their influence upon the output of urobilin. In 6 cases of pernicious anemia with splenectomy, the urobilin output, which had previously been high, showed a marked decrease immediately after operation. Two cases in which the urobilin later returned to a high figure, as well as one case in which there was a persistently increased output, showed definitely less improvement than the two cases in which the urobilin remained normal. Three of the four patients transfused gave evidence of a resulting bone marrow stimulation, and at the same time showed a temporary increase in urobilin excretion. The one case in which transfusion was without effect showed no such increase. In 3 patients treated with salvarsan, there was practically no effect, either on the course of the disease or on the urobilin excretion. It seems fair to Robertson to conclude that: (1) variations in the urobilin output may be taken as an index of corresponding changes in the course of the disease; (2) such variations in the urobilin may occur before there is any change in the number of red cells; (3) the determination of the urobilin output as an index of blood destruction is the most accurate means we have of estimating the effect of treatment.

The same author<sup>3</sup> has endeavored to determine the *hemolytic activity of the spleen* in pernicious anemia. He obtained fresh spleens at operation from six patients with pernicious anemia, and found that extracts of the spleen pulp, made with both normal salt solution and alcohol, possessed no hemolytic properties. An ethereal extract, on the other

<sup>1</sup> Archives of Internal Medicine, May 15, 1915.

<sup>2</sup> Ibid., September, 1915.

<sup>3</sup> Ibid., October, 1915.

hand, showed a marked hemolytic action. However, the hemolytic substance contained in this extract belonged to the group of unsaturated fatty acids and had been obtained in equally strong concentration from the normal liver and intestine. The only change in the splenic vein blood obtained at operation, which could not be accounted for by manipulation, was a decreased resistance of the red cells. These cells were definitely less resistant than those of the peripheral circulation in the same individuals and in normal controls. These findings seem to exclude any gross or easily demonstrable manifestation of hemolytic activity on the part of the spleen. However, the decreased resistance of the red cells in the splenic vein, would suggest that the spleen in pernicious anemia elaborated some toxic substance or enzyme which so injures the blood cells during their passage through that organ that they are more susceptible than normally to destruction elsewhere. It seems probable that in some other part of the body there is elaborated an abnormal hemolysin or an abnormally acting normal hemolysin.

ASSOCIATIONS. From a study of the disturbances in the central nervous system accompanying pernicious anemia, Rogers<sup>1</sup> concludes that pernicious anemia is the result of a *toxemia* or *autotoxemia* acting on the tissues of the body in general, but showing a selective action for certain tissues, preferably the red blood cells and nervous tissue. Certain types of pernicious anemia cases, in which symptoms indicating involvement of the nerve centres are first to appear, may readily be confounded with tabes, paresis, myelitis, insular sclerosis and even hysteria, the diagnosis resting with the blood examination. In cases of pernicious anemia with marked involvement of nerve tissues, the blood findings are less characteristic, and, too, these cases manifest a greater tendency toward remissions, making the prognosis more favorable.

Pfeiffer<sup>2</sup> reports on the pathological findings in a case of pernicious anemia with psychic implication. From these findings he concludes that cerebral alterations can be demonstrated in pernicious anemia, and that, in cases of psychic phenomena, changes in the cortical neurone occur similar to those found in the psychosis of toxemic origin.

Bramwell<sup>3</sup> has written on *the association of pernicious anemia with subacute combined degeneration of the spinal cord*. He declares this spinal affection to be a rare condition, and bases his study on the notes of 5 cases which came under his observation. He agrees with Collier that in these cases the anemia is not the cause of the spinal lesion, but that the anemia and spinal lesion are due to a common cause, probably a toxin or perhaps several different toxins. This view he believes more probable than that of Nonne's, which suggests that the cord lesion

<sup>1</sup> Wisconsin Medical Journal, October, 1915.

<sup>2</sup> Journal of Nervous and Mental Diseases, February, 1915.

<sup>3</sup> Edinburgh Medical Journal, April, 1915.

is due to vascular changes, the result of the anemia. In some cases of subacute combined degeneration, the anemia precedes, in others it occurs coincidentally with, and in others it follows, the spinal symptoms; in other words, the development and severity of the spinal symptoms do not depend upon the development and severity of the anemia. It seems reasonable to suppose, since clinical and pathological facts seem to support this view, that: (1) In some cases the toxin acts entirely on the blood, the result being pernicious anemia without spinal symptoms; in this group are included the great majority of cases; of 140 cases of pernicious anemia of which the author kept daily records, there were only 4 cases of subacute combined degeneration. (2) In some cases the toxin acts entirely or chiefly upon the spinal cord. In these cases there is subacute combined degeneration without anemia, or with a slight anemia; these cases are rare. In some of the cases included in this group in which the anemia was at first slight, and in which the blood changes in the early stage were not suggestive of pernicious anemia, profound pernicious anemia is ultimately developed. (3) In some cases the anemia precedes the development of spinal symptoms; this seems to be the most frequent type of subacute combined degeneration. (4) In some cases, the toxin from the first, or at all events at the time when the patient comes under observation, acts on the blood and the spinal cord, the result being typical pernicious anemia with subacute combined degeneration of the spinal cord. Interesting references to the association of lesions of the central nervous system with pernicious anemia were reported in *PROGRESSIVE MEDICINE*, June, 1913, p. 308, and June, 1914, p. 333.

TYPES. Kleinschmidt<sup>1</sup> under the title of "aplastic" (aregeneratory) hemolytic anemia in children describes 4 cases of anemia occurring in children between the ages of four and twelve. This affection is characterized by hemolysis in the blood itself and failure of the bone marrow to produce new cells. The red cell count is considerably decreased, but there are not special changes in the shape of the cells. There is neither megalocytosis, poikilocytosis or polychromatophilia; there are no basophile granules; erythroblasts were not found except in one case, and then only a few. The color index is generally lower than 1. The character of the white cells is not changed, but they are decreased considerably in number, especially the polymorphonuclears, so that there is a relative lymphocytosis. There are no eosinophiles; the number of blood platelets is greatly decreased. The anemia generally ends fatally in from six to nine months; one case lasted for a year and nine months. There are no remissions in the disease, and all attempts at treatment have failed, including iron and arsenic treatment and blood transfusion.

<sup>1</sup> *Jahrbuch f. Kinderheilkunde*, January, 1915.

One of the most important things about the disease is the pronounced tendency to hemorrhages in the skin, mucous membranes, and internal organs. There is a slight yellowish tinge to the skin, but not the straw-yellow of pernicious anemia. Neither urobilin nor urobilinogen could be demonstrated in the urine. While many of the clinical symptoms are similar to those of pernicious anemia, the blood picture is very different. Neither the blood picture nor the clinical findings alone are pathognomonic of a blood disease, but the combination of the two is. So this may be considered an entirely separate disease of unknown toxic origin.

Frank<sup>1</sup> discusses an affection which he calls aplastic (aregenerative) anemia-panmyelophthisis. The condition develops as a hemorrhagic purpura which continues a steadily progressive course until the patient succumbs to the anemia in the course of a few weeks or months. He reports in detail a case in a woman, aged thirty-three years. She had contracted syphilis fourteen years before, but was apparently in good health, when given an additional mild course of mercury and salvarsan. Eight days after its conclusion the hemorrhagic purpura developed and progressed to a fatal ending in fifteen days. In this, as in all the cases on record, the small numbers or total absence of blood platelets was a marked feature. The affection seems to be a primary leukomyelotoxicosis, with secondary anemia partly from the loss of blood and partly from myelophthisis. It is a very different condition from pernicious anemia. Without examination of the blood, the cases would generally be classed as sepsis. The "hemorrhagic aleukia," as he also calls it, opens the portals to septic infection. It may come on as an ulcerating or necrotic throat or mouth trouble; in his cases there was buccal periostitis. The sepsis is simply an accident in the course of primary toxic destruction (aleukia) or overproduction (aleukemia) of myeloid tissue.

In another paper on aplastic anemia developing from benzol or Röntgen exposures, Frank<sup>2</sup> refers to Selling's report of a case of fatal poisoning from inhaling the fumes of benzol. In this and in two similar cases, the red-blood cells were comparatively little affected; the white cells showed the brunt of the attack. The result is a leuko-anemia, not an erythro-anemia, and myelophthisis is the cause of the trouble. Frank reports a case of myeloid leukemia in a woman, aged thirty-nine years, who was given a brief and mild course of Röntgen treatment, under which the blood count returned practically to normal. The changes that were started in the blood kept on, however, until the count reached the absolute opposite of what it had been, the leukemia being superseded by aleukia. Decastello has lately reported a similar case. In both, the complete transformation occurred under Röntgen

<sup>1</sup> Berl. klin. Wehnschr., September 13, 1915.

<sup>2</sup> Ibid., October 11, 1915.

exposures of the spleen. This suggests that the spleen may have a special function in some circumstances, shown by inhibiting and impairing the functioning of the bone marrow. This special function seems to be set in action by the influence of Röntgen exposures, and also by the influence of certain morbid processes in the spleen itself. Frank says that this syndrome of morbid conditions in the spleen, accompanied by subnormal numbers of leukocytes and blood platelets, brings us to the cause of toxin production in hemorrhagic aleukia. For a long time it has been mistakenly included in the group of "aplastic anemias."

These cases of Kleinschmidt, and those referred to by Frank, apparently belong to that type which has heretofore been termed "aplastic anemia" which was discussed in PROGRESSIVE MEDICINE, June, 1915, p. 335. Musser's paper, there referred to, gives an excellent general discussion of this affection.

**TREATMENT.** The discussion of the treatment of pernicious anemia in the literature of the year has been confined almost wholly to consideration of *splenectomy* as a therapeutic measure in this disease. Bramwell has received the impression from the results obtained in the treatment of pernicious anemia by arsenic by the mouth, given in the form of Fowler's solution on the one hand, and by salvarsan and neosalvarsan given intramuscularly on the other, that the latter plan is more favorable. The comparative results in the two series of cases—110 cases treated by arsenic by the mouth, and 21 cases treated by salvarsan or neosalvarsan intramuscularly are shown in the following tables:

#### IMMEDIATE RESULTS.

	No improvement in. Per cent.	Slight improvement in. Per cent.	Marked improvement in. Per cent.	Complete (or temporary) recovery in. Per cent.
110 cases treated by Fowler's solution . . . . .	36, or 32.7	22, or 20.0	40, or 34.5	14, or 12.7
21 cases treated by salvarsan or neosalvarsan . . . . .	6, or 28.5	3, or 14.2	5, or 23.8	7, or 33.3

#### ULTIMATE RESULTS UP TO DATE.

	Not known. Per cent.	Fairly well. Per cent.	Quite well. Per cent.	P. A. Per cent.	Death. Other causes Per cent.
110 cases treated by Fowler's solution . . . . .	12, or 10.9	4, or 3.6	2, or 1.8	85, or 77.2	7, or 6.3
21 cases treated by salvarsan or neosalvarsan . . . . .	.....	1, or 4.7	5, or 23.8	13, or 61.9	2, or 9.5

In giving the neosalvarsan, the author prefers the intramuscular method because of its more sustained effect, and because it is perhaps

less hazardous than the intravenous method. In the earlier cases he employed salvarsan, and, in the later ones, neosalvarsan. The local effects from the latter are perhaps slightly less unpleasant than from the former, while apparently there was little difference in the constitutional effects. The author doubts whether neosalvarsan is so effective in the treatment of pernicious anemia as salvarsan. The beneficial results were, on the whole, he thinks, more marked in the cases treated by salvarsan than those treated by neosalvarsan. In some of the 21 cases treated by salvarsan or neosalvarsan which died from the disease, the immediate beneficial results of treatment were very striking. In some, in which the improvement at first was only slight, very marked improvement ultimately occurred. In none of the cases was there any reason to suspect previous syphilis, and in those cases in which the Wassermann test was employed the result was always negative.

Bartolotti<sup>1</sup> has found that under the influence of *antidiphtheria serum* the red cells increase in number. This is at its height on the fourth or fifth day and then gradually declines, but never drops to its former figure. The effect is most marked when the number of red cells is small to begin with. Antistreptococcus and antistaphylococcus serums have the same action, but it is less marked than those of diphtheria antitoxin. The author has also noticed that extracts of various organs have a notable influence in this line in serious secondary anemia. On the basis of this, he treated a woman, aged thirty-eight years, with severe pernicious anemia unamenable to iron and arsenic, with antidiphtheria serum, giving four injections of 1000 units each, with intervals of forty, sixteen and twenty-one days. A week after the first injection, he commenced combined organotherapy, giving extract of spleen, spinal cord and blood, alone or combined; the daily dose was about 0.5 gm. of the extract, slowly increasing to 2.75 gm. a day and then tapering off. By the fourth day after the first injection of antitoxin, the reds had increased from 823,750 to 1,618,000 and by the sixth week to 3,832,000, while the hemoglobin from 35 to 30 had risen to 90 per cent. Nearly six months after suspension of all treatment—the complete course having taken thirteen weeks—the hemoglobin was 90 per cent. and the reds numbered 5,084,000; the blood findings otherwise were also normal.

A notable discussion of *pernicious anemia in its relation to the spleen* has been contributed by Moffitt.<sup>2</sup> This article does not lend itself to abstracting, and the reader is referred to the original article.

Barren<sup>3</sup> gives the results of a study of the *blood picture before and after splenectomy* in a case of pernicious anemia. The blood examination

<sup>1</sup> Polyclinico, Rome, May 9, 1915.

<sup>2</sup> American Journal Medical Sciences, December, 1915.

<sup>3</sup> Journal-Lancet, Minneapolis, August 15, 1915.

up to five weeks before operation showed hemoglobin about 35 per cent.; red-blood cells, 2,000,000; hemoglobin index about 1; white blood cells 3500; marked anisocytosis; slight poikilocytosis; polychromatophilia and granular degeneration; practically no normoblasts, no megaloblasts, no "Howell-Jolly" bodies. The patient's condition grew progressively worse under medical treatment, and splenectomy was performed. The hemoglobin, which was near 25 per cent. at the time of operation, rose slowly until it reached 48 per cent., fifteen weeks later. The red-blood cells arose from 1,300,000 to 1,900,000. The leukocyte count soon rose to normal, and stayed about normal. The shape and size of the red cells gradually grew better; polychromatophilia and granular degeneration remained about the same. Normoblasts increased until at one time there were 1400 per cm. A few megaloblasts were seen, but later disappeared. The most remarkable and pronounced change, however, was in the appearance of the "Jolly" bodies soon after the splenectomy. These nuclear remnants not only persisted, but increased to enormous numbers, in the blood. Unfortunately, a perinephritic abscess appeared about three and one-half months after the operation, and this seemed to keep back the improvement. The patient died about a month later.

The results of splenectomy in 3 cases of pernicious anemia, reported by v. Jagie,<sup>1</sup> show that while this procedure eliminates some elements of the clinical picture, it does not eliminate the cause. The operation was followed by improvement in the general condition at once. The 3 patients have gained respectively over 17, 24 and 26 pounds in seven, eleven and nine months since the operation. They all feel well and strong, but the blood picture shows little improvement, and is still of the pernicious type. After a period of improvement in the third case, there was retrogression, but the administration of arsenic brought about improvement and the case progressed favorably.

In 5 cases of pernicious anemia, which Lee, Vincent and Robertson<sup>2</sup> treated by splenectomy, the immediate results of the operation were a prompt postoperative recovery and a definite remission of the disease in every case. The remissions were much more marked than is usually seen in pernicious anemia. In 4, of the 5 cases, the red counts rose to from 4,000,000 to 5,000,000. The remissions occurred so constantly that the authors are inclined to attribute them to the splenectomy.

The study shows that, in spite of marked improvement, the blood picture still exhibits the accepted characteristics of pernicious anemia with the exception of the color index, which has been altered from high to normal or low. Furthermore, in 3 of the 5 cases, evidence of increased blood destruction was present several months after splenectomy, as shown by the urobilin estimation. These facts the authors can

<sup>1</sup> Wien. klin. Wechschr., November 26, 1915.

<sup>2</sup> Journal of American Medical Association, July 17, 1915.

interpret only as evidence that the disease is not cured. It cannot as yet be stated that the improvement brought about by this means will last longer than the remissions which come spontaneously and which may persist over a period of years. Because of the very nature of the disease, it will be many years before the exact value of splenectomy can be determined.

The only conclusions we may safely draw from these cases, combined with the reports of other writers are that:

Splenectomy is not a very serious operation in pernicious anemia, it offers a definite means of inducing a remission, and the remission thus brought about is more marked in the majority of the cases than that from any other known therapeutic procedure.

In a discussion of *splenectomy in primary pernicious anemia*, Roblee<sup>1</sup> concludes that primary pernicious anemia is probably due to a toxin which may be of bacterial, chemical or parasitic origin. In some cases there is an increase of the unsaturated fatty acids. The spleen seems to exercise a favorable influence on the elaboration of these substances. These toxins appear also to produce a hyperemia of the splenic pulp because of changes in the bloodvessels, which cause the blood to be poured directly into the pulp. The presence of the spleen seems to decrease the amount in the blood of the total fats and cholesterins which are antihemolytic. For these theoretical reasons, and because of the many cases on record in which a cure has been obtained in Banti's disease, which is closely related to pernicious anemia, splenectomy appears to be indicated in these and the closely associated anemias.

Removal of the spleen, either in sickness or in health, does not affect the patient injuriously. The operative mortality is not high even in very weak patients.

A rapid and striking remission of all symptoms appears, the change in the blood picture coming quickly and quite certainly. It is too early for us to know whether or not any patients will be permanently cured, but it is quite probable that a large percentage will succumb to the disease within a few months after operation. Other methods of treatment should be combined with splenectomy, as more than one factor is doubtless at work in these cases. It will certainly extend life, and, in our incomplete knowledge of the etiology of this disease and the surety that death will come under every other known method of treatment, I believe that these patients should be offered this additional chance of recovery. We must remember that some patients have been reported symptomatically well at the end of nine months, even though the blood was not entirely normal.

**Chlorosis.** Von Jagic<sup>2</sup> believes that some constitutional anomaly analogous to the status hypoplasticus or lymphaticus is the basis of

<sup>1</sup> Journal of American Medical Association, March 6, 1915.

<sup>2</sup> Med. Klinik, Berlin, January 17, 1915.

chlorosis. Girls without this constitutional predisposition may become anemic, debilitated, tuberculous or may starve, but they do not develop chlorosis. It is seen as well among the well-to-do as in the poorer classes, but it is not so common as is generally believed, many cases being erroneously labeled. This term should be restricted to true chlorosis which is a disease caused by disturbances in the internal secretions of the genital organs, and entails disturbances in blood production and especially in production of hemoglobin. It shows the close connection between the internal secretion of the ovaries and blood production. The interaction of all the ductless glands is also probably a factor in chlorosis. In the Abderhalden test, ovarian and uterine substance is digested in chlorosis.

Menstruation is not normal in girls with chlorosis. Von Noorden found incomplete menstruation in 77.2 per cent. of his cases of chlorosis. von Jagic goes so far as to maintain that normal conditions in regard to menstruation practically shut out chlorosis. The primary and secondary sexual characters ripen early with chlorosis; the breasts are well developed as a rule, possibly a trifle too full. Low hemoglobin percentage may accompany unusually large numbers of red cells, but in chlorosis the color index is unusually low. Absolute lymphocytosis may be encountered, especially when the thyroid is involved. Lymphocytosis and especially mononucleosis, must be regarded as one of the signs of physical inferiority, particularly in persons of the hypoplastic type. Another finding occurring often in chlorosis is the high position of the diaphragm; even when reclining, the respiration is shallow, the diaphragm not making properly deep excursions on account of the infantile position of the ribs. The constitutional inferiority may be seen further in narrow bloodvessels and vulnerable endocardium. Pronounced mitral defects are not uncommon in women who have passed through severe chlorosis and have no history of serious infection at any time.

**Erythremia (polycythemia).** Little has appeared in the literature of the past year on this condition. A notable piece of work, however, has been done by Lamson<sup>1</sup> on the role of the liver in the production of acute polycytemia. A summary of the results records that the corpuscle content of the blood is a constantly varying quantity under physiological conditions. Certain new means have been found by which the red count may be rapidly and greatly increased, such as, (*a*) through the production of lung emboli, by the injection of corpuscles hardened with formaldehyde; by the injection of an inert powder, such as lycopodium, or the injection of oil; (*b*), through emotional stimuli, such as fright and rage. The polycytemia produced by the injection of epinephrin is due to the action of the liver alone. Ligature of the arterial supply to the liver excludes the production of polycytemia

<sup>1</sup> Journal of Pharmacology and Experimental Therapeutics, July, 1915.

after the injection of epinephrin. Later, release of this ligature allows the customary increase in the number of red cells to take place without the further injection of epinephrin. The liver effects this increase in the number of red cells by (*a*) a decrease in plasma, not sufficient to account for the entire increase in the number of red cells, however; (*b*) by bringing into the circulation red cells which were not present before the production of polycythemia, as shown by their reduced size and their reduced percentage of hemoglobin content. These cells give none of the usual reactions of young cells. There is an absence of nucleated red cells, no change in the fragility of the corpuscles and no increased metabolism of the red cells themselves, as shown by an increased rate of reduction. It is contended that there is a mechanism for the regulation of the red corpuscle content of the blood, that the regulatory mechanism is under nervous control, reacting to lack of oxygen as a stimulus; that the adrenal glands play a role in this mechanism and that the liver is the organ which supplies the body with red cells to meet its acute demands.

A case of erythremia has been reported by Mellon.<sup>1</sup> The patient was a male, aged fifty years, who worked as a sailor on the Great Lakes. He had always enjoyed good health. For the past year he had had periodic attacks of a throbbing headache, associated with bloating of the stomach and abdomen, which symptom had no relation to the time of eating. Cyanosis was general, but more intense in the extremities and face. There was no dyspnea. The systolic pressure was 195; diastolic 169. The spleen was palpable on deep inspiration and noticeably enlarged to percussion. The blood findings on December 11, 1914, were: Reds, 10,270,000; whites, 10,700; hemoglobin, 140 plus (Fleischl); color index, 0.6; sp. gr., 1.089 plus; fibrin diminished. No pathological changes were found in the red cells; a measurement of 100 cells showed them to vary between the limits of 7.1 and 7.8 microns. The differential showed little or no variation from the normal, excepting a decreased percentage of lymphocytes. The spectroscopic test for methemoglobin and sulphemoglobin proved negative; Wassermann reaction negative; coagulation time normal. Centrifugation of 5 c.c. of specimen for half an hour resulted in the separation of but a few drops of serum. Viscosity readings were taken at a temperature of 35° C.; four normal bloods averaged 3.13; the patient's blood was 5.52. The study of the urine showed an output of 1820 c.c.; sp. gr. 1012; total solids 57.8 grams; urea 27.4; albumin a decided trace; sugar negative; indican negative. There was a moderate number of hyaline and granular casts, and many cylindroids along with a few erythrocytes. The author concluded, from a study of his case, that it was a typical one of erythremia. Benzol in the dose given did not produce any change.

<sup>1</sup> New York Medical Journal, September 25, 1915.

in the patient's condition. Although the number of red cells have been reduced to normal in some instances through the use of this agent, such a procedure would seem of questionable value for two reasons: (1) because of the sudden deaths occurring in cases of leukemia where apparently only good had resulted from the drug; (2) because, according to the findings of von Jaksch, its administration would seem to be illogical. If, as he shows, the corpuscles are of lessened physiological worth, then the increase in number would seem to be compensatory. A destruction of this excess would then react only in deleterious fashion. Since the further symptoms that this patient complained of were readily ameliorated by nitroglycerine, the author did not think it justifiable to resort to drastic measures merely to reduce the number of red cells.

Clark<sup>1</sup> reports a case of erythremia occurring in a male, aged fifty-one years, who had been a seaman by occupation and spent the most of twenty years of his life about South American ports. Seven years previous to coming under observation, the patient had had a series of three or four severe gastric disturbances necessitating the use of morphin. At about this time, he started from Glasgow for Rio Janeiro and was vaccinated before starting. Very soon after this he noted intense redness of the face, with numerous dilated bloodvessels. This discoloration was gradual and progressive, and for a long time his temples, forehead and chin were free, although the conjunctivæ were suffused, as were the mucous membranes of the mouth and throat. The discoloration was bright red in hue, although it sometimes became purplish. The principal subjective symptoms were a feeling of weakness, and a sense of fulness in the abdomen. The erythrocyte count on various occasions ranged from ten to twelve million. The spleen was enlarged, the urine brown in color, clear, with a sp. gr. of 1016; albumin abundant; creatin fairly abundant; urobilin, a trace. The Wassermann reaction was negative. The blood showed increased viscosity and a deep cyanotic color. It flowed rather freely from a large puncture and coagulated rather slowly; the coagulation time in a number of observations was found to be rather more than seven minutes. The blood examination, made in June, 1915, showed 10,972,350 red cells; 10,230 white cells; 132 per cent. hemoglobin, with a color index of 0.605. The differential count revealed 86.5 per cent. polymorphonuclears; 5.5 per cent. mononuclears; 1.75 per cent. large lymphocytes; 2.0 per cent. small lymphocytes; 2.75 per cent. eosinophiles; 0.25 per cent. "transitionalis;" 1.25 per cent. mast cells. The red cells were well formed and there were no poikilocytes or other morphological abnormalities; one normoblast was seen. In all, 920 c.c. of blood were removed from the patient, and, from the estimated reduction in hemoglobin, the total amount of blood circulating was calculated as described by Dreyer. This worked out at 10,188 c.c.,

<sup>1</sup> Glasgow Medical Journal, November, 1915.

the normal being about half of this. The sp. gr. of the blood was found to be 1071.83, as against 1057 to 1066 for normal blood. In normal blood the relative amount of plasma and corpuscles is approximately equal. In the patient's blood, plasma was only 24 per cent. of the total, and corpuscular elements 76 per cent. From a chemical analysis of the blood, it was found to be deficient in moisture and high in organic matter. Water was 66 per cent. as against 74 per cent. in the normal blood; organic matter and ash were 33 per cent. as against 25 per cent. in normal blood. Phosphoric acid was very much diminished, and amounted to about one-fifth of the normal. The iron, estimated as  $\text{Fe}_2\text{O}_3$ , was about double; calcium, estimated as  $\text{CaO}$  was trebled. After a discussion of this case, the author concludes that none of the theories advanced is entirely satisfactory. Erythremia may occur as a consequence of disease of one or other of the organs connected with erythrocyte production and destruction. It may be due to errors in production alone, or to errors in the hemolytic organs or to both. It is probably not due to errors in the hemoglobin. The case here cited will be carefully watched, and a further report of the patient's condition published in due course.

#### THE SPLEEN.

**Experimental.** Jamison<sup>1</sup> has been carrying out experimental *ligation of the splenic arteries* in dogs with the idea of producing atrophy of the spleen and thus supplying a substitute measure for splenectomy. Ten dogs were operated upon. The spleen pedicle was firmly ligated, both the veins and the arteries being included in the ligatures. Two dogs died of shock and hemorrhage within a few hours; four dogs lived over one week and less than three weeks; the remaining four lived over four months, in apparent perfect health, and were finally killed in the course of other experiments. Of the four dogs which lived over one week and less than three, necrosis of the spleen was demonstrated at necropsy in three of them, and, in the other, an enormous central abscess of the spleen was found. Cultures of the pus from this abscess failed to show a growth on Löffler's blood serum or agar, and no organisms could be demonstrated in stained smears.

Of the four dogs that survived, two were laparotomized some four months after the first operation and atrophied spleens removed. Both of these dogs recovered from the second operation without incident. One dog died five months after the operation; in this case the spleen was atrophied, and no evidence could be found that its condition had contributed to death; the liver was found infected with coccidia and affected with advanced cirrhosis; filarial worms were found in the heart; the latter probably produced the dog's death. It is evident, then, that

<sup>1</sup> New Orleans Medical and Surgical Journal, September, 1915.

mere ligation of the splenic pedicle is extremely unsatisfactory, although successful in 50 per cent. of the cases, and that it would be entirely unjustifiable to subject a human patient to such a risk. Two dogs were experimented with late in January. The same steps were followed as above, except that large veins to the spleen were carefully isolated and not included in the ligatures. Both dogs died within ten days, and necrosis of the spleen was demonstrated at necropsy, showing that patency of the veins did not hinder the necrosis. In looking over the necropsy records and certain specimens preserved from the experiments, Jamison found that, in cases in which the dogs recovered, the spleen was absolutely covered by the omentum, but that in cases in which the dogs developed necrosis of the spleen, the omentum had apparently failed to envelop it. It was further observed that in one dog which survived three weeks after operation, the omentum had enveloped over half of the spleen, and that this part of the organ showed atrophy, while that part uncovered by omentum showed necrosis.

In the next experiments the abdomen was opened in the usual manner, and the splenic pedicle ligated, the arteries and veins being included in the ligatures, but the spleen was then covered by the great omentum, and the abdomen closed. Up to date, five dogs have been treated in this manner and have recovered without incident. It was evident that in the four dogs that recovered from mere ligation of the pedicle, a severe crisis had been passed during the ten days following operation; this was not the case with the last five, which showed no evidence of any trouble more than would follow any simple laparotomy. In those cases in which the spleen was covered by omentum, the degree of atrophy was greater than that following simple ligation, and came about in a shorter time—about three weeks, as nearly as could be determined. These results, according to Jamison, need further confirmation, and are not presented with the idea of applying them to the human at the present time; but with the idea of helping other experimentors along these lines and with the idea of pointing out a way by which uniform results may be obtained with the greatest degree of certainty of putting the spleen out of function.

Goldschmidt and Pearce<sup>1</sup> have studied the metabolism in four dogs before splenectomy and at intervals of from three days to three months after splenectomy. In three of the four animals, the removal of the spleen was not followed by any disturbances of nitrogen metabolism, fat utilization, or iron elimination. Two of these animals showed no anemia, and the third only a slight reduction in hemoglobin and number of red cells. A fourth animal, studied ten days and three months after splenectomy, developed eventually a definitely progressive anemia of moderate severity. This animal showed a slight loss of weight, a

<sup>1</sup> Journal of Experimental Medicine, September, 1915.

slight disturbance of nitrogen balance, and of creatin and creatinin partition, with a marked increase in the elimination of iron. The authors conclude, therefore, that the spleen has no important influence upon metabolism, and that the disturbances occurring in one of their dogs were due to the coexisting anemia and not to the absence of the spleen.

*Changes in the blood following diversion of the splenic blood from the liver* have been investigated by Krumbhaar, Musser and Peet.<sup>1</sup> Their experiments show that in dogs whose splenic veins had been ligated or transplanted into the inferior vena cava, or in which an Eck fistula had been made, an anemia occurs resembling that following splenectomy and showing the same general variation in degree and duration. The resistance of the red cells to hypotonic salt solution is quickly increased; sometimes coincident with, and sometimes preceding, the anemia. As a rule, it gradually returns to normal in about the same length of time as it takes the anemia to disappear, but may remain increased for longer periods. There is an initial leukocytosis involving at first the polymorphonuclear leukocytes, and the transitional cells. As the total leukocytosis diminishes, there is both a relative and actual increase of small lymphocytes, and usually of eosinophiles. This may be either temporary, or may last during the entire period of observation, and differs from the ordinary postoperative leukocytosis. Ligation of the splenic vein is followed by considerable atrophy of the spleen, but not by necrosis or thrombosis. There is rarely adequate new vein formation. The other operations cause little or no change in the spleen. Whether the disturbances as described are due to the loss of a certain volume of blood to the liver, or, as has been previously suggested, to the loss of a splenic hormone, it is impossible to say. If the former is true, the method of the production of the anemia still remains unexplained. It is evident, furthermore, that the latter theory has also no value, unless it is assumed that this hormone must be activated by passage through the liver.

Krumbhaar and Musser<sup>2</sup> have found that dogs whose splenic veins or portal vein (Eck's fistula) had been transplanted into the inferior vena cava, or whose splenic veins had been ligated, showed a lessened tendency to jaundice similar to that exhibited by splenectomized animals. Although the previously existing anemia and the concomitant increased resistance of the red cells of these animals are undoubtedly factors in the greater resistance to hemolytic agents, the lessened tendency to jaundice is, in part at least, due to a mechanical factor dependent upon the source of the blood supply to the liver. The additional anemia caused in the test animals by hemolytic agents is usually less than in the controls, although the total fall from the original number of red cells

<sup>1</sup> Journal of Experimental Medicine, January, 1915.

<sup>2</sup> Ibid.

may be greater. This applies to the splenectomized, as well as the other, test-animals, and is a modification of the authors' former statements in regard to the severity of the anemia in splenectomized dogs. Although the destruction of blood in these animals is less than in the normal controls, the repair of the same takes considerably longer than in the controls. This confirms similar results previously obtained in splenectomized animals.

The white cells exhibit much the same changes as they do following the administration of hemolytic agents to splenectomized or normal animals. As these changes are not unlike those following uncomplicated splenectomy, or the operations here discussed, they cannot be considered as characteristic of any of the above procedures, or perhaps as an accompaniment of any temporarily increased blood destruction. The reaction of test and control animals is substantially the same, whether the jaundice is caused by tolulylendiamin or hemolytic immune serum.

Experiments have been carried out by Austin and Pepper<sup>1</sup> which show that when hemoglobin is set free in the portal circulation, a large amount is held by the liver and converted rapidly into bile pigment than is the case when it is set free in the general circulation, and that, under the former condition, overloading of the liver with bile pigment more readily occurs and jaundice is more apt to develop. The authors conclude that this mechanical influence must, therefore, be a factor in the lessened tendency, after splenectomy, to the jaundice which follows blood destruction due to hemolytic agents, for whether the spleen be an active factor in destroying the erythrocytes, or whether it plays merely a passive part as a place for the deposition of the disintegrating cells, there can be no question that in this organ, when it is present, a large number of cells undergo their final disintegration after the action of hemolytic poisons, and that the hemoglobin there liberated passes by the portal system directly to the liver. When the spleen is removed, this disintegration occurs in other organs, notably in the lymph nodes and bone marrow, and the hemoglobin from these organs passes not into the portal, but into the general, circulation, from which it reaches the liver more gradually and in a more dilute form.

In studying the *influence of diet upon anemia following splenectomy*, the experiments of Pearce, Austin and Pepper<sup>2</sup> showed that the anemia which develops after splenectomy is most marked in animals on a mixed table-scrap diet of meat, bread, cereals and vegetables, which is essentially a cooked diet. Control studies, in which a unilateral nephrectomy precedes splenectomy, demonstrate that the anemia is not due to operation, hemorrhage, or accidents of convalescence, but develops only in the absence of the spleen. The results of studies of the influence of

<sup>1</sup> Journal of Experimental Medicine, December, 1915.

<sup>2</sup> Ibid.

food containing a large amount of iron in presumably easily utilizable form, as in raw beef spleen, do not support the view that the anemia is due to lack of iron in the food. Observation on the influence of a diet of raw meat, as contrasted with cooked meat, shows a more severe anemia in animals on the cooked diet, and suggests the possibility that heat alters some substance which, in the absence of the spleen, the body cannot utilize. A final conclusion in regard to this point must, however, await the results of more detailed studies now in progress.

Kolmer and Pearce<sup>1</sup> have found experimentally that anesthetics, as ether, chloroform, and, to a certain extent, urethan, generally weaken, or remove temporarily, the power in normal rabbit and dog sera of absorbing or fixing complement with lipoidal and bacterial antigens in a non-specific manner. This alteration usually is not apparent at once after the administration of the anesthetic, but is found after one to three days. Later, the serum returns to its former power of causing this non-specific complement fixation. The administration of ether does not alter negatively reacting sera in such manner as to bring about positive reactions. Nitrous oxid-oxygen anesthesia has no appreciable influence on the serum reactions of normal rabbits. Splenectomy alone has probably no influence upon the property in normal rabbit and dog sera of fixing or absorbing complement with various non-specific lipoidal and bacterial antigens, the effects being in larger degree attributable to the anesthetic. The changes observed in dogs following splenectomy under ether were somewhat more profound than those in rabbits.

Experiments are reported by Lewis and Margot<sup>2</sup> which show that in all probability the increased resistance to tuberculous infection which is imparted to mice by the removal of the spleen is a consequence of the loss of a function of the organ. This function can be restored by feeding of fresh spleen. The authors attribute these changes to the removal and restoration, as the case may be, of a particular substance for which the designation *tuberculosplenatin* is suggested. This substance is assumed to be related to the spleen as epinephrin is related to the epinephric gland. It is peculiar to the organ but not to the species. It is not found in other organs of the body, so far as their observations have extended. The absence of the substance from the lymphatic glands seems of special importance in this connection.

Lewis and Margot<sup>3</sup> have shown experimentally that the intoxication which is developed when splenectomized mice are fed with fresh spleen is more regular in occurrence when the feeding experiment is carried out four or five days after splenectomy than when it is done at later periods. The intoxication is easily recognizable, even in the less severe forms, by a lengthening of the coagulation-time of the blood. An intoxication of the same character is produced when splenectomized

<sup>1</sup> Journal of Infectious Diseases, January, 1915.

<sup>2</sup> Journal of Experimental Medicine, September, 1915.

<sup>3</sup> Ibid.

mice are fed with the mucous membrane of the stomach and upper small intestine. Bone marrow and dried blood probably give the same reaction in a somewhat milder form. The other organs either give no intoxication at all when fed, or, in certain instances, the thyroid, adrenal and salivary gland (mouse) give intoxications of a different character which affect intact mice and splenectomized animals equally. The spleen or the gastro-intestinal mucosa is equally affected in producing the intoxication, whether it be derived from heterologous or homologous species. Certain experiments, not reported in detail, indicate that the susceptibility to intoxication disappears in time, and that this time may be shortened by repeated feedings with sublethal amounts of organ substance.

**Pathology.** Sprunt<sup>1</sup> discusses the nature of an occasional feature in the *pathology of splenomegaly*. Microchemical studies have shown that we have here to do with a selective impregnation of an elastic tissue with the phosphates of calcium and iron, giving rise to ochre-colored patches about as large as grains of wheat. He refers to the findings of Gibson and of Yates, Bunting and Kristjanson<sup>2</sup> who held that these lesions were an evidence in favor of the infectious nature of splenic anemia. Sprunt says that all the material in these lesions stains readily in the tests for iron. It is easily dissolved and disappears from the section when treated with dilute mineral acids, or strong oxalic acid, leaving a hyaline area which stains very poorly, because of the so-called "elacin" reaction of Unna, but does not take the usual elastin stain. Gibson considers these lesions as probably pointing to a parasitic invasion of the organ by a streptothrix organism, but Sprunt declares that the several strains of streptothrix organisms which he has tested may be exposed to 10 per cent. mineral acid for over an hour with little or no change in their staining reactions.

Wilson<sup>3</sup> has studied the *pathology of spleens removed for certain abnormal conditions of the blood*. The average age of patients with a blood picture of splenic anemia at the time of operation was thirty-six years. The average duration of symptoms was thirty-two months. The average weight of the spleen was 1130 grams. Histologically, the most constant features were the marked reduction of the pulp and lymphoid tissue, with the great increase of reticulum and almost constant presence of amyloid degeneration and arteriosclerosis. The average age of patients with pernicious anemia was forty-four years at the time of operation. The average duration of symptoms was twenty-seven months. The average weight of the spleens removed was 463 grams. Cytologically, the increase was mostly in the lymphoid tissue, though in one case there was a well-marked fibrosis, this spleen weighing almost twice the average

<sup>1</sup> Johns Hopkins Hospital Bulletin, September, 1915.

<sup>2</sup> See PROGRESSIVE MEDICINE, June, 1915, p. 351.

<sup>3</sup> Annals of Surgery, August, 1915.

weight of the glands in the series. The almost entire absence of pigment in these relatively early stages is again in contradiction to the usually accepted statement that, in cases of pernicious anemia, the spleen is pigmented. The cases of hemolytic anemia, syphilis and hemolytic jaundice resembled pathologically the cases of splenic anemia. The cases of secondary infection, lymphosarcoma, acute febrile, non-septic splenomegaly, and splenomegaly with eosinophilia, had little pathological relationship to either splenic anemia or pernicious anemia. The lymphosarcoma case was typical lymphoma whose malignancy was shown clinically. The other three cases gave the general picture of intense acute or subacute infection, causing hypertrophy and hyperplasia of all the parenchymal elements of the spleen, without material increase in the reticulum.

The author observes that at present the clinical diagnoses of splenic anemia, pernicious anemia, secondary infectious anemia, hemolytic jaundice, Gaucher's disease, etc., are all lacking in clearness, a condition which must be materially improved upon before the instructive parallel may be shown, if, indeed, any exists between the several clinical syndromes in their various stages and the pathological picture present in the spleen.

**Physiology.** In summarizing a discussion of the *functions of the spleen* Hirschfeld<sup>1</sup> says that the spleen is not concerned in the formation of red cells, and of the white blood cells it forms only the lymphocytes and the large mononuclear elements. Under certain pathologic relations, as in leukemia, anemia, and infectious diseases, the spleen is capable of forming also red blood corpuscles and granulocytes. It is the place where red corpuscles are destroyed, and here the hemoglobin is obtained which later in the liver is formed or changed into bilirubin. It plays an important part in the metabolism of hemoglobin, and in this respect assists the liver. It is concerned in the metabolism of iron. The spleen is a regional lymph gland of the blood which becomes the grave of not only the red blood corpuscles, but also the white blood corpuscles and all foreign elements coursing in the circulation. This organ regulates the erythroplastic function of the bone marrow. An inexplicable relation exists between the spleen and digestion, in that the spleen at the height of digestion is swollen and very rich in blood. It likewise has the power, at least in some animals, to contract itself. These contractions are dependent upon the influence of the nervous system. In man, this phenomenon has not been established. These functions of the spleen are not indispensable, any one of them can be quickly assumed by some other organ, and there is no appreciable general disturbance after removal of the spleen in most cases. There are, however, individuals who cannot get along without the spleen, and who react to splenectomy with a grave disturbance, polycythemia.

<sup>1</sup> Deut. med. Wehnschr., September 16, 1915.

In an investigation as to the production of bile pigment in the spleen in cases of pernicious anemia, Banti's disease, hemolytic jaundice and other affections accompanied by excessive hemolysis, van den Bergh and Snapper<sup>1</sup> have compared the blood from the splenic vein with blood taken from a peripheral vein, either immediately after death or at operations permitting this. They found in all of four operative cases, and in two cases that ended in death, that the serum from the splenic vein contained a great deal more bilirubin than the serum of the peripheral blood. In some cases this difference was threefold. The serum from the spleen was much darker in color. Everything in their findings indicated that the bilirubin in question was formed in the spleen.

**Primary Splenomegaly. SPLENIC ANEMIA, BANTI'S DISEASE, GAUCHER'S DISEASE.** A number of case reports of these conditions have appeared in the literature of the past year. Krumbhaar<sup>2</sup> concludes an excellent analysis of the clinical types of splenomegaly accompanied by anemia with the statement that splenectomy should be considered in all those diseases in which there is evidence of increased blood destruction, and that in early Banti's disease and hemolytic jaundice, at least, the results of splenectomy have been excellent. All such procedures, however, should be entered on most conservatively so long as so much of the physiology of the spleen remains unknown. Though its removal is known to be compatible with life, it may yet prove to have such important detoxicating relations to infection or to digestion, that splenectomy should only be practiced after most careful study and to relieve the most serious conditions.

Truesdale<sup>3</sup> reports a case of splenic anemia occurring in a female, twenty-one years of age. She had anemia at seven years; otherwise no illness of importance. For five years she had indigestion, attacks of hematemesis occurred at least as often as once a year. Stools were always tarry before an attack; epigastric pain during the second attack was severe, and tenderness across the upper abdomen subsided only after many days. About November 20, 1911, she noticed that the stools were tarry. A few days later she vomited blood. During this attack there was acute pain in the epigastrium, with local tenderness which was quite marked. Examination in January of 1912, showed a well-developed and nourished girl, perceptibly anemic. Palpation of the abdomen revealed an enlargement of the spleen; the lower margin of which was about half-way between the costal margin and umbilicus. Examination of the gastric contents after a test meal showed free HCl 10, total acidity 30. No bacteria, blood or pus. The blood examination revealed 2,400,000 red cells, 30 per cent. hemoglobin,

<sup>1</sup> Nederlandsch Tijdschrift voor Geneeskunde, April 3, 1915.

<sup>2</sup> American Journal of Medical Sciences, August, 1915.

<sup>3</sup> Boston Medical and Surgical Journal, March 11, 1915.

color index .62, and 3800 white cells. No normoblasts, no megaloblasts; some variation in size of the red cells but not marked. Four days later the leukocytes were 3000 in number, of which 78 per cent. were polymorphs, 14 per cent. lymphocytes, 4 per cent. myelocytes, 4 per cent. eosinophiles. On January 31, 1912, a laparotomy was done, but the spleen was not removed. On April 22, 1913, splenectomy was done. At this operation the liver was found to be grayish, but its surface was smooth, and its consistence apparently normal. The operation was completed with the patient in fair condition. Convalescence was slow, but it was marked by a progressive improvement in the blood picture and in the general health. At the time of this report, eighteen months after the operation, she has passed her probationary period in a training school for nurses connected with a hospital of a neighboring city. The last blood count was January 1, 1915, which revealed 1200 white cells, 5,600,000 red cells and 85 per cent. of hemoglobin.

Lindbom<sup>1</sup> reports a case of chronic thrombosis of the splenic and portal veins which simulated Banti's disease. The patient was a woman, aged fifty-six years. At forty years the spleen enlarged, and, at forty-six years, she began to vomit blood at times. After five years of this, Banti's disease was supposed to be responsible for the clinical picture, especially as ascites developed four years later requiring frequent tapping. The liver findings were normal, but the blood showed anemia, with low color index and large numbers of nucleated reds resembling the blood picture after splenectomy. The trouble proved to be the result of syphilitic changes in the vessel walls, entailing thrombosis of the splenic vein. The portal vein becoming involved likewise brought ascites in time. The special features which differentiate the condition from Banti's disease are the advanced age, the long, stationary course, and the relative lymphopeny. Splenectomy is peculiarly risky in such cases, and the effects uncertain, as the source of the trouble is not in the spleen but in the splenic and portal veins. The Wassermann reaction was constantly negative, but Lindbom suspected the syphilitic nature of the trouble from a perforation found in the septum, a history of optic neuritis twenty-one years before, ascribed to an assumed brain tumor at the time, and the fact that the temperature fluctuated under potassium iodid. An intercurrent erysipelas hastened the fatal outcome.

Steedly<sup>2</sup> reports a case of Banti's disease in which splenectomy was done, notwithstanding the fact that, at operation, the liver showed well-marked cirrhotic changes. This feature of the case caused the author considerable anxiety, because of doubt as to whether the hepatic cirrhosis would increase and later produce symptoms of its own, or whether the splenectomy, by removing the cause, would arrest the liver cirrhosis and allow the organ to perform its functions unhampered.

<sup>1</sup> Hygiea, Stockholm, 1915, lxxvii, No. 13.

<sup>2</sup> Journal of South Carolina Medical Association, October, 1915.

The patient was a female, aged thirty-eight years, married. Upon admission to the hospital, July 14, 1911, her weight was 120 pounds. Blood examination revealed 3,840,000 erythrocytes, 50 per cent. of hemoglobin, and 9240 leukocytes. She was greatly reduced in flesh and strength, and splenomegaly was marked, the anterior border of the spleen reaching beyond the umbilicus. The operation was followed by an uneventful convalescence. She was feeling much better on leaving the hospital three weeks later, and in a few months felt as well as ever in her life. In November, 1914, blood examination revealed 4,949,000 red cells, 85 per cent. hemoglobin, and 13,500 white cells. She had gained forty-five pounds in weight. She looked and felt perfectly well and so continues at the present time.

Roberts<sup>1</sup> reports a case including an early splenectomy and necropsy two years later. The average number of white cells in eight counts before operation was 4925; the lowest, 2700; highest, 5500. The average of twelve counts after operation was 15,985; lowest, 9000; highest, 85,000. There was throughout a rather unusually high hemoglobin percentage, the general average being 62 per cent., the average color index was .8; highest, omitting one of 2.2 and one of 1.4 occurring soon after sharp hemorrhages, was 1; lowest, 0.6. A notable irregularity in the shape and size of the red cells was always present, and during the last year became pronounced. Gastric and intestinal hemorrhages occurred only after the removal of the spleen. There was no jaundice or pigmentation of the skin, even during the Banti's stage. There were several periods of improvement, two especially prolonged and pronounced, suggesting recovery; but there was no corresponding improvement in the condition of the blood. Splenectomy, even done early, did not arrest the disease or modify its course in any way. The clinical diagnosis of uncomplicated splenic anemia was apparently confirmed by the necropsy. The only other important pathological condition was a moderate grade of parenchymatous nephritis; but this did not seem sufficient to account for the death of the patient, and, moreover, the progress of the case to the end was like that of splenic anemia, not nephritis.

In a case reported by Collins and Riddell,<sup>2</sup> the lymphatic glands in the abdomen had undergone a hyperplasia of their histological elements similar to what occurred in the spleen. Blood was present in the lymph sinuses of these lymphatic glands to a variable extent, but the amount of blood present bore no relation to the hypertrophy of the endothelial cells or fibrous tissue of the gland. The hemorrhage into the mesentery and the blood in the ascitic fluid suggested that the blood corpuscles in the sinuses of the lymph glands had been transferred *via* the ordinary lymph paths. It seemed, however, more probable to the authors that these hemolymph glands represent blood organs, *sui generis*, in which

<sup>1</sup> Journal Lanceet, Minneapolis, August 15, 1915.

<sup>2</sup> British Medical Journal, May 29, 1915.

the same pathological changes had occurred as in the other blood organ, the spleen, than that the great hyperplasia of the endothelial cells and fibrous tissue was simply the result of the presence of red corpuscles in the lymph paths of normal lymphatic glands. A small angioma was present on the anterior surface of the liver. Areas of fibrosis and collections of small round-cells were present about the portal system, and, to a less extent, in the intercellular tissue. A certain amount of fatty infiltration was present, more marked near the angioma. The capillaries were distended with blood. The pancreas appeared to be perfectly normal. The sections of the lungs showed the presence of emphysema. A section was made through the origin of the portal vein at the junction of the mesenteric and splenic veins, as the site most likely to be diseased. The walls of the vein were quite healthy. A portion of the splenic artery exhibited early atheroma. Sections of the suprarenal glands exhibited no abnormality. The kidneys exhibited the histological changes of chronic interstitial nephritis, the left kidney being considerably more fibrosed than the right.

BANTI'S SYMPTOM-COMPLEX IN ITS RELATION TO SPLENECTOMY is discussed by Blake,<sup>1</sup> who reports 3 cases, in one of which the spleen was removed. The author advises that splenectomy in splenic anemia, or Banti's symptom-complex, should be recommended under the following conditions: (1) in adults, when the diagnosis is agreed upon by a good physician and a competent surgeon; (2) when the condition of the patient is sufficiently good to withstand what may be a serious operation, or when a poor condition can be sufficiently improved by one or more previous transfusions; (3) in children, only after a thorough trial of all possible medical methods of treatment, including fresh air, sunshine, careful nursing, liberal and appropriate diet, as well as the judicious exhibition of drugs. In a large majority of cases, a high white count, or a considerable recurring or continuous fever, is a contra-indication. In children, also, the agreement of physician and surgeon is an essential preoperative requirement.

Gaucher's Disease. Bernstein<sup>2</sup> makes an interesting report of a case of Gaucher's splenomegaly in which the diagnosis was made previous to operation by means of splenic puncture. The patient was a sister of a boy who had been successfully splenectomized about two years previously for what was clinically diagnosed as Gaucher's disease, and which proved to be this disease by histological study of the spleen. Aside from this family history, and a markedly enlarged spleen, there were no symptoms pointing to, or warranting, the diagnosis of Gaucher's splenomegaly in the sister. However, she was referred from the dispensary to the surgical service of the hospital for operation. At the author's suggestion, splenic puncture was done before operation in order

<sup>1</sup> Annals of Surgery, Philadelphia, September, 1915.

<sup>2</sup> Journal of American Medical Association, June 5, 1915.

to establish the diagnosis. A simple puncture with a good-sized needle and syringe was made, and sufficient splenic pulp and blood mixture were aspirated to render a good-sized drop in the needle. This was spread over cover-glasses, fixed with methyl alcohol and stained with Giemsa solution. The characteristic multinucleated endothelioid cells were found in abundance, and thus the diagnosis was established. The spleen on removal showed the typical pathological picture of Gaucher's disease, both in parts of the spleen pulp and in sections of the organ. Aspiration, therefore, according to the author, has been proved to be of final diagnostic importance and should be especially valuable in doubtful cases.

A case of large-celled splenomegaly (Gaucher) has been reported by Bruce and Mabee.<sup>1</sup> The disease occurred in a male, aged forty-six years, of probable Jewish extraction. Other members of the family are well so far as could be ascertained. The patient had tertian malaria twelve years ago, and for the last ten years has not felt so well as before. The chief symptom during the last two years has been the enormous enlargement of the spleen. Other symptoms, developing more recently, were marked weakness, bronze pigmentation of the skin, loss of weight, epistaxis, and a moderate degree of simple anemia with leukopenia. Splenectomy was successfully performed. The patient made a good recovery from the operation which was performed on February 7, 1911, and at the present time he is enjoying good health. Histological examination of the spleen revealed the presence of the typical large multinucleated endothelioid cells.

**Hemolytic Icterus.** No notable advances have taken place in our knowledge of these conditions during the past year, although we have obtained a record of metabolism studies in a case of the acquired disease, both before and after splenectomy.

**PATHOLOGY.** Upcott<sup>2</sup> reports a case of the congenital or Chauffard type in which splenectomy was performed. In the light of Gibson's<sup>3</sup> findings, it is interesting to note the pathological report on this spleen. The organ was enlarged to about three times the adult size, and presented a normal shape. The surface was smooth, with slight thickenings where the trabeculae met the surface. Some old, localized perisplenitis was seen on the concave surface, and there was some recent perisplenitis along the anterior border. The color was dark red. On cross-section, the organ was firm and fleshy; the Malpighian corpuscles could be recognized imbedded in a red matrix. Upon careful examination of a number of cut surfaces, there could be seen, here and there, buff-colored, pin-head areas, usually with or without trabeculae. They did not occupy more than a millimeter of the length of the trabeculae. The

<sup>1</sup> Canadian Medical Association Journal, October, 1915.

<sup>2</sup> British Journal of Surgery, April, 1915.

<sup>3</sup> PROGRESSIVE MEDICINE, June, 1915, p. 351.

microscopical examination revealed a diffuse fibrosis, with thickening of the trabeculae. The pigmented spots seen by the naked eye showed a diffuse, black staining with Wheal Chown's stain, and some irregular curved and angular, thick threads only partially stained black. There were clear, unstained bands interrupting the threads; short forms and bacilli were present. There was much less yellow pigment here than elsewhere. In two of the sections, a black, irregular network was present under the capsule in places which showed a buff pigmented spot to the naked eye. On histological grounds, there was an undoubted invasion of the organ by a filamentous organism of the streptothrix type. Cultures have been made and from them have been obtained pure growths of an organism which belongs to the streptothrices. Studies of the reactions and pathogenicity of these organs are not yet complete.

Faber<sup>1</sup> reports in detail two cases of *congenital hemolytic jaundice*; one occurring in a girl, aged seventeen years, whose father and four of seven other children showed the typical picture of this disease; the other in a girl of eighteen, all the members of whose family are healthy, showing no signs of jaundice, anemia or splenomegaly. In addition, he cites the case histories of three patients with the congenital type of the disease treated by splenectomy. In these cases, the fragility index of the erythrocytes was determined before operation and again three or four years after operation. This index was found to be as high after the operation as before. In all three cases, hemolysis of the reds became evident in 0.8 salt solution. In spite of the persistent fragility of the erythrocytes, the patients apparently were restored to health by the operation. The author considers the erythrocytic fragility the essential factor in this disease, and this is the factor which is inherited. The splenomegaly is secondary, but, after splenectomy, the erythrocytes apparently are able to hold their own and hemolysis is not readily brought about.

METABOLISM. McKelvy and Rosenbloom<sup>2</sup> report a case of the congenital type of the disease in a girl, aged eleven years, in which they carried out a metabolism experiment for five days. Their findings showed that there was a loss of 4.06 grams of nitrogen, while the urinary nitrogen partition is normal in character with the exception of the uric acid nitrogen, which is increased. The absorption of nitrogen was normal. The urinary sulphur partition was normal in character with occasional increased excretion of ethereal sulphates. In five days there was a loss of 1.88 grams of sulphur. In the five days there was a loss of 0.482 gram of calcium oxid, and 0.924 gram of magnesium oxid. There was a phosphorus retention of 0.07 gram while the amounts of earthy phosphates and total phosphates may be considered normal. There was a loss of 0.1199 gram of iron in the five days, with marked

<sup>1</sup> Hospitalstidende, June 16, 1915.

<sup>2</sup> Archives of Internal Medicine, February, 1915.

increased amounts of iron excreted in the urine and feces. The fat metabolism was normal, with an absorption of about 91 per cent. of the ingested fat. The amounts of neutral fat, fatty acids and soaps in the stool were normal. Urobilin and urobilinogen were present in the urine and feces. Bilirubin and hemoglobin were absent from the urine and feces.

Goldschmidt, Pepper and Pearce<sup>1</sup> have studied the metabolism before and after splenectomy in a case of congenital hemolytic jaundice occurring in a boy, aged five and a half years. Splenectomy was followed by a disappearance of the discoloration of the skin, and a rapid improvement in the condition of the blood, along with a striking improvement in general health. Metabolism studies, before and after splenectomy, gave the following results: A slight positive nitrogen balance before splenectomy was followed by an increased retention eight days after operation. The output of uric acid showed a decrease of 47 per cent. after operation. In the period directly after operation, a change in the partition of creatinin and creatin elimination occurred; the total creatinin, however, showing but slight change. Other urinary nitrogen constituents showed no variations from the normal, and no change was found in the hydrogen-ion concentration. The utilization of nitrogen was good at all times. Fat metabolism was normal. There was a large loss of iron through the feces before the splenectomy, followed by a decided decrease (40 per cent.) after operation. The excretion of urobilinogen and urobilin in the feces was markedly diminished after splenectomy; the amount after operation was about one-ninth of that excreted before splenectomy.

TREATMENT. Elliott and Kanavel<sup>2</sup> have collected and analyzed the results of operation in 48 cases of hemolytic icterus treated by splenectomy. Of these, only two patients died, one shortly after operation, and the other in six weeks from sepsis, a surprisingly good result when one considers the serious condition of some of the patients. As for the ultimate results, the 46 patients who recovered are reported as "cured"; that is to say, they were relieved of their jaundice and crises. The effect on the blood picture was immediate. In 7 cases reported in the first two weeks, 4 gained from 1,000,000 to 2,000,000 reds; in 8 cases reported in the third and fourth weeks, 3 gained over 1,000,000, 2 over 2,000,000, and 1 over 3,000,000; in 9 cases reported in from three to six months, 5 gained 2,000,000, 4, 3,000,000, and 1, 5,000,000; and, finally, of 10 reported after six months, 1 gained 1,000,000, 5 gained 2,000,000, and 4 gained 3,000,000, leaving one that had not gained appreciably, the blood count here showed 4,500,000. These increases in every case brought the blood approximately to normal; in 22 cases it was above 4,000,000, and of these, in 17 above 4,500,000, and, in 3,

<sup>1</sup> Archives of Internal Medicine, September, 1915.

<sup>2</sup> Surgery, Gynecology and Obstetrics, July, 1915.

6,000,000 or over. The hemoglobin followed the rise in the number of reds. The white blood count was normal unless there were complications. The effect on the fragility of the red blood cells was less conspicuous. The fragility was increased before operation in every case, varying from 0.50 to 0.70. One case is mentioned in which the condition became normal in five weeks, but for the most part little change was noted before three months, when several are mentioned as being nearly normal. The jaundice decreased in most cases in the first few days, and in nearly all instances was absent at the end of two weeks, while the acholuric crises, with the attendant malaise, headache and fever, ceased entirely. While too few observations have been made over long enough time to estimate the effect upon the gall-bladder complications, it is not unreasonable to assume that the tendency to these would be decreased or removed.

### HEMORRHAGIC DISEASES.

**Purpura, Hemophilia, Melena Neonatorum.** No notable advance in our knowledge of the hemorrhagic diseases has taken place during the year, yet a number of minor, though important, facts relating to coagulation of the blood have been brought forth. In a study of the FACTORS AFFECTING THE COAGULATION TIME OF THE BLOOD, Mendenhall<sup>1</sup> has carried out numerous experiments to determine the *influence of certain anesthetics*. He found that coagulation time is little changed by chloral hydrate unless it is normally short, then it is prolonged. Coagulation time is affected by chloroform as by chloral hydrate, namely, if the process is affected at all, it more usually is prolonged rather than hastened. Mendenhall suggests that the effects of chloral hydrate and chloroform are probably the result of disturbance and consequent interaction between two or more organs which are important in the coagulation process; probably liver (intestine?) and suprarenal glands. The evidence is not enough to prove that a retarding agent is produced. Coagulation processes are hastened by ether anesthesia. The effect of ether is exerted wholly through its action on the suprarenals.

The *effect of chloroform on the factors of coagulation* has been investigated by Minot.<sup>2</sup> From his experiments, Minot found that antithrombin is rendered inactive by chloroform and ether, thus allowing free thrombin, if present in an oxalated plasma, to clot fibrinogen. Prothrombin is not converted to thrombin by chloroform. Chloroform can precipitate both fibrinogen and prothrombin from an oxalated plasma. Chloroform does not weaken the action of a solution of pure thrombin. Ether does slightly. Antithrombin could not be recovered from chloroform or ether extracts of serum or plasma, unheated or heated to 60° C.,

<sup>1</sup> American Journal of Physiology, July, 1915.

<sup>2</sup> Ibid., December, 1915.

and is not exactly identical to antitrypsin or to Doyon's antithrombin. In one chloroform-poisoned rabbit, the antithrombin of the blood was decreased below normal.

Hurwitz and Drinker<sup>1</sup> have studied the *factors of coagulation in experimental aplastic anemia of benzol poisoning* with special reference to the origin of prothrombin. They found that subcutaneous injections of benzol in rabbits produce marked destructive changes in the hematopoietic organs, especially in the myeloid tissue. Benzol poisoning registers a change not only in the formed elements of the blood, but also in the factors of coagulation. The circulating prothrombin is considerably reduced in amount, and, in most instances, animals in which such a decrease occurs show aplasia of the bone marrow. The association of extreme aplasia of the marrow without a fatal diminution in the circulating prothrombin suggests one of two possibilities; either other tissues and organs, in addition to the bone marrow, are concerned with prothrombin formation; or a minimum amount of myeloid tissue suffices to maintain the quantity of prothrombin above a dangerous level. The myeloid tissue plays no part in the production of antithrombin. Bone marrow activity is not essential for the production of fibrinogen.

The ORIGIN OF ANTITHROMBIN has been a subject of research by Denny and Minot.<sup>2</sup> They reached the conclusion, from their experiments, that antithrombin is formed in the liver. They found that venous blood taken from the liver, spleen, kidneys and intestines shows no appreciable difference from jugular vein blood in antithrombin content. When stasis is produced in these organs, the liver blood alone shows a definite increase in antithrombin. Perfusion of the liver with defibrinated blood causes an increase of antithrombin in the perfusate. Perfusion of the head, spleen and hind leg shows no marked increase and generally a decrease, in the antithrombin content. Attempts to stimulate the liver to production of antithrombin by means of bile, bile salts, secretin and electrical stimulation were negative. Injections of small amounts of thrombin into the portal circulation caused a slight rise in antithrombin. Dogs with phosphorus poisoning and liver destruction show a very marked decrease in antithrombin content of the blood, as well as diminished fibrinogen.

Lee and Vincent<sup>3</sup> have studied the RELATION OF CALCIUM TO DELAYED COAGULATION OF THE BLOOD IN OBSTRUCTIVE JAUNDICE. Their results seem to show that while the effect of bile in delaying the coagulation is largely counteracted by calcium, yet bile has, in addition, an inhibitory effect on the formation of thrombin and on the action of thrombin already formed. Moreover, bile in very strong concentration, *in vitro*, entirely prevents coagulation, even in the presence of an excess of calcium.

<sup>1</sup> Journal of Experimental Medicine, May, 1915.

<sup>2</sup> American Journal of Physiology, 1915, xxxviii, No. 2.

<sup>3</sup> Archives of Internal Medicine, July, 1915.

It is doubted, however, if, in obstructive jaundice, such concentration of bile ever occurs as will entirely prevent coagulation of blood. Clinically, this need of calcium can be met by the administration of any calcium salt. The authors have generally used calcium lactate in the dosage of 100 grains a day. It must be administered over a period of several days before any marked effect on the coagulation time is seen. The necessity of employing large doses depends on the difficulty of securing the absorption of calcium from the gastro-intestinal tract, rather than the need of such large amounts of calcium.

Continuing the work reported last year,<sup>1</sup> Ledingham and Bedson<sup>2</sup> have accumulated data, which they report, on the blood changes in guinea-pigs after inoculation with anti-guinea-pig-plate serum. An early fall in the number of platelets simultaneously with the outburst of skin purpura is found to be a marked feature. Purpura has also been produced in rabbits and rats by inoculation with the respective antiplate serum. The changes in the blood of rabbits have been followed with results somewhat like those found in the guinea-pigs. The authors found that antiplate serum, in addition to its purpura-producing properties, possesses, in common with other cytolytic sera, considerable lytic powers, which in all probability contribute largely toward the fatal issue in small animals. Death, however, may occur as a result of extensive hemorrhages alone without any obvious lytic changes, as evidenced by hemoglobinuria. Serum obtained by immunization with red cells or leukocytes did not produce purpura. Purpura was not produced by inoculating animals with heterologous antiplate serum.

The authors state that the histology of the purpuric lesions will form the subject of a later communication.

TESTS. Hess<sup>3</sup> has described a *method for the estimation of antithrombin in the blood*. The procedure is as follows: About 9 c.c. of blood are aspirated and put into 1 c.c. of 1 per cent. sodium oxalate. The blood is centrifugalized, and the plasma removed in the usual way. The plasma is then recalcified by adding two, three, four and five drops, respectively, of a 0.5 per cent. calcium chloride solution. In this way we ascertain the general coagulability of the plasma, which is a composite of a number of interacting factors—prothrombin, fibrinogen, antithrombin, etc.—and we determine, at the same time, the optimal amount of calcium for this particular plasma. If we heat some of this plasma to 60° C., the prothrombin, as is well known, is destroyed, and the fibrinogen is coagulated. After filtering off the coagulum, we have a plasma which contains antithrombin and practically no prothrombin. The strength of this antithrombin may be ascertained for clinical purposes as follows: (1) We prepare human plasma from a normal case

<sup>1</sup> See PROGRESSIVE MEDICINE, June, 1915, p. 353.

<sup>2</sup> Lancet, February 13, 1915.

<sup>3</sup> Journal of Experimental Medicine, April, 1915.

just as we prepare the oxalated plasma which is to be tested. Five drops of this plasma are put into five thoroughly cleansed vials. The first of these serves as a control. To the second, three drops of normal antithrombin are added. To the third, five drops of normal anti-thrombin; to the fourth, three drops of the antithrombin that is to be tested; to the fifth, five drops of this antithrombin. All tubes are equalized in amount by the addition of normal salt solution, and the mixtures are allowed to remain in contact for fifteen minutes. The plasma is then recalcified by the addition of 0.5 per cent. calcium chloride, the number of drops which are added having been determined by the general coagulability test which should always precede the antithrombin test. As a rule, four drops have been found to be the optimal amount. The chief advantage of the test is that it is simple, and does not require the preparation of fibrinogen and of thrombin, which are difficult to prepare and to maintain in a pure state. As the result of examinations carried out by this method, it would seem that there is a wide factor of safety as regards the amount of antithrombin in the human blood, and that this inhibiting substance may be increased to a considerable degree without markedly delaying or endangering clotting.

**Purpura.** In a discussion of CONSTITUTIONAL PURPURA, Frank<sup>1</sup> states that hemophilia is distinguished from purpura chiefly through its hereditary character. The symptoms of these diseases are so alike that purpura could be called pseudohemophilia. In purpura, however, the joints are not affected, and the petechiae, as a rule, do not occur to the same extent. The author cites a number of cases from the literature of the chronic form of purpura which accompanies the individual through life. In addition he reports 3 cases in detail which came under his own observation. In no cases has he known of complete recovery from the disease, and he believes that in most cases the reported recovery from an acute attack may be simply a subsidence to latency of a chronic purpura, which happened to be seen during a period of exacerbation. In the first case reported by Frank, coagulation began after a few minutes and was complete in twelve minutes; the blood platelets in this case were practically absent. In the second case, coagulation began at nine minutes, and was complete at fifteen minutes. Here again the blood platelets were almost entirely absent. In the third case, the beginning of coagulation was at sixteen minutes, and was complete at thirty minutes (room temperature 21.5°). The blood platelets in this case were estimated at 120,000 to the cubic millimeter. Frank is convinced that the pathogenesis of purpura is due to a constitutional deficiency in the blood platelets, so he prefers to call the disease essential thrombopeny instead of constitutional purpura or pseudohemophilia. The distinguishing characteristic of constitutional purpura, according to the

<sup>1</sup> Berl. klin. Wehnschr., May 3 and 10, 1915.

author, is an extraordinarily prolonged bleeding time along with a normal coagulation time.

Mann, Jr.<sup>1</sup> reports a case of purpura hemorrhagica in which there was a profound leukopenia. On January 5, 1915, only 610 leukocytes per cubic millimeter could be counted; this after every effort had been made to eliminate errors. Some of the counts were as low as 300 and 400 per c. mm. On January 7, the leukocytes were 1560; on February 6, after recovery, the white blood cells numbered 5200.

*PURPURA HEMORRHAGICA PAPULOSA ET PUSTULOSA* is the term applied to an interesting affection described by Waldheim.<sup>2</sup> At the end of March, 1915, after typhus had broken out among the Serbs in the retention camp at Mauthausan, one of the prisoners, aged forty-two years, was brought to the author's isolation ward where, on examination, the following interesting condition was revealed. Over the whole trunk and, to an even greater extent, over the arms and legs, were found numberless deep violet, hard, hemispherical or pointed nodes from the size of a millet seed to that of a lentil situated on a violet or brown ground whose color was not lost on pressure. Some of these nodes showed at their points small, white vesicles; others showed larger pustules, with or without umbilication. Accompanying these skin lesions were great constitutional weakness and prostration. The countenance was livid, the lips blue, the pulse almost impalpable and there were severe pains in the hands and feet. Thinking of smallpox, the patient was isolated, and further observations carried out. The body temperature was 36.2°. Weakness increased with each day and death occurred in a week's time, after the patient had eaten nothing for three days. He had only taken water. Since then the author has noticed the occurrence of numerous other cases of a similar kind. The nodes were generally on the legs and arms around the knee and elbow-joints, leaving the hands and feet free. Among the severer cases, the abdomen, breast, sacral region and back also showed the eruption. Finally, the true nature of the disease was revealed when a patient who felt well in spite of the widely distributed eruption, suddenly, one evening, developed hemorrhage from the mouth and nose, and died in a quarter of an hour. The postmortem examination showed that neither disease of the lungs nor ulcer of the stomach was present. The stomach contained fresh blood and its mucous membrane showed countless punctiform hemorrhages. The immediate thought was that death occurred from internal hemorrhage due to purpura hemorrhagica. But here was no *morbus maculosus*, but a *morbus papulosus*, which here and there advanced to a *morbus pustulosus*. Change of diet, which was repeatedly carried out, had no influence on the disease. Of 159 of these patients in Waldheim's ward, only 75 were cured. No less than

<sup>1</sup> United States Naval Medical Bulletin, July, 1915.

<sup>2</sup> Med. Klinik, August 22, 1915.

84 died of purpura, a fact which shows how malignant this affection can be.

**Hemophilia.** Hess<sup>1</sup> has studied a case of hemophilia occurring in a child, aged six years, which had been under observation for three years. The case was studied both clinically and metabolically, and showed a deficiency in calcium. From the studies made, the author concluded that typical hereditary hemophilia is not associated with a deficiency of calcium. His investigations showed, as had others previously, that the addition of calcium to the blood *in vitro* delays, rather than hastens, coagulation. Furthermore, a deficiency could not be established by quantitative determinations of the calcium in the blood, and a metabolism study showed that the exchange of lime salts, as well as of numerous other inorganic as well as organic substances, differed in no way from normal. To him, however, hemophilia did not seem to be a sharply circumscribed entity, if there were grouped under hemophilia disorders characterized by the three main criteria of this disease—delayed clotting of the blood, a normal number of platelets, and a negative “capillary resistance test.” If it be demanded that the defect is hereditary, it is possible that no variation in type will be found. The atypical instance studied by the author was of the sporadic variety, but had all the other symptoms of classical hemophilia and therefore could not be considered as a case of purpura. The boy studied, showed a definite deficiency in the calcium of the blood from a functional point of view, the addition of a weak solution of calcium markedly hastened the clotting of the blood. Quantitative determinations of blood calcium also showed a deficiency compared with the normal. In addition, a study of his general metabolism brought out the fact that there was a negative balance of lime, which became positive when lime salts were added to the diet. Although the author does not wish to make the conception of hemophilia more complex, or to burden its nomenclature, it would seem to him that this instance must be considered a distinctive type of the disorder under consideration, an instance of calcium deficiency or a *hemophilia calcipriva*.

DuPan<sup>2</sup> reports a case of hemophilia occurring in a boy, aged fifteen years, and discusses at length the *joint manifestations* of this disease. In the case reported, there was a very painful tumor of the ankle which bore some resemblance to sarcoma. Upon incision, dark blood was obtained but no pus. The incision bled for three days continuously, confirming the ultimate diagnosis of hemophilia. The use of calcium chloride and diphtheria antitoxin eventually arrested the bleeding. The boy's family showed the usual inheritance of the tendency to bleed, this tendency being transmitted through the females to the males of the third generation. Of five sons in this family, three were pronounced

<sup>1</sup> Johns Hopkins Hospital Bulletin, November, 1915.

<sup>2</sup> Rev. méd. de la Suisse Romande, October, 1915.

hemophiliacs. The author concludes that hemophilia is a familial hereditary malady which is transmitted through the females to the males of the third generation. It consists in a diminution in the coagulability of the blood which favors the production of spontaneous hemorrhages, often incoercible and fatal. The hemorrhages are often articular or subperiosteal. They produce hemarthroses which simulate abscess, sarcoma, osteomyelitis, or, more often, tubercular arthritis. An error in diagnosis may lead to an operation, with perhaps a fatal issue. It is, therefore, necessary to study the affection. Investigation of the family and personal history, and examination of the blood establishes the diagnosis of the disease. The articular hemorrhages usually persist, and lead, through irritation, to chronic hemophilic arthritis which resembles white swelling or coxalgia, and leads to functional impotence. Hemophilia attenuates spontaneously with age. It is rarely dangerous after the twenty-fifth year.

**Treatment of Hemorrhagic Disease.** Fonio,<sup>1</sup> in discussing the improved outlook for the treatment of hemophilia, purpura, etc., states that the prevailing methods of testing the coagulation of the blood give no information regarding the causes of the delay in coagulation.<sup>2</sup> The author describes a method which reveals the exact factors involved, and apparently opens a wide field for future research on the blood. Although the technic is still imperfect, yet it already throws light on the nature of hemophilia, purpura, etc., and suggests effectual treatment. He calls it the "separierende methode," as it aims to determine which of the elements of the blood is lacking in the individual case. It opens a brighter prospect for transfusion of blood in diseases of the blood, as it enables us to select and apply in transfusion the one or more elements needed, leaving out the other elements which are merely undesirable ballast.

It is known that coagulation is the result of the release of thrombozym by the destruction of the blood platelets. It combines with the thrombogen to form thrombin, while the latter—in the presence of calcium salts—acts on the fibrinogen and from this action fibrin results. If any one of these four factors is lacking—either blood platelets (thrombozym) thrombogen, fibrinogen or lime—coagulation is retarded. Hence it is important to isolate and examine each of these elements separately. This he accomplishes approximately by the use of hemophilic or other similarly slowly coagulating blood as an index, applying the blood to be tested to this index blood, and noting the effect on it. He records the coagulation time in three phases, represented by a dotted line, a heavy black line and another dotted line. The first represents the time that elapses before there is a trace of coagulation, the heavy black line the

<sup>1</sup> Corresp. Blatt. f. Schweizer Aerzte, 1915, xlv, No. 48.

<sup>2</sup> See Scheme devised by Austin and Pepper, PROGRESSIVE MEDICINE, June, 1914, p. 369.

period from the first traces to complete coagulation. The second dotted line represents the period of retraction of the clot. By this graphic method, comparative study of each case is facilitated, as he shows by a number of examples, the relative lengths of the lines showing which of the four elements isolated is most at fault. He recalls that it is a simple matter to isolate the blood platelets. Two drops of a suspension of the platelets from patients with purpura, or exophthalmic goitre, or healthy controls, were added to six drops of blood from a hemophiliac. The length of the various lines in each test shows at a glance that purpura platelets behaved like normal platelets. Equal amounts of each in separate tests compel the hemophilic blood to coagulate within normal range. His further tests apparently demonstrated that hemophilic blood contains normal proportions of platelets, but that they are qualitatively insufficient. In purpura, on the other hand, the platelets are qualitatively normal, but are present in insufficient numbers. When the blood is deficient in thrombozytæ, it can be brought up to normal by injection of blood platelets (Fonio's "coagulen"), without injecting unneeded elements along with them, as in transfusion of the whole blood.

Riedl<sup>1</sup> reports an interesting case of marked pulmonary hemorrhage successfully treated by the intravenous injection of Fonio's "coagulen." On May 19, marked hemorrhage from the lungs set in. In spite of absolute rest, the use of an ice-bag and the administration of morphia, styptizin, ergotine subcutaneously, and erystyptizin and calcium lacticum internally, the bleeding continued, and a severe grade of anemia developed, accompanied by deep pallor, a running pulse of small volume, vertigo and faintness. On May 30, in this condition, when the case was almost hopeless, an intravenous injection of coagulen was administered. One gram of the powder was dissolved in 10 cm. of distilled water and boiled for one minute, and the whole of this solution was delivered into the basilic vein of the left elbow. During two hours after the injection, blood was coughed up, but no more after that period. Six hours afterward the sputum showed merely streaks of blood. The patient improved after this from day to day. On June 8, the patient got up. The point of interest Riedl calls attention to in this case is not the action of the coagulen in a case of pulmonary bleeding in the course of tuberculosis, but much more the circumstance that there was a rapid and lasting favorable result in spite of the fact that there was present an undoubtedly hemophilia.

Halpern<sup>2</sup> reviews his experience with extract of blood platelets (coagulen), and concludes, upon the ground of his excellent results, that this substance is a valuable hemostatic in bleeding carcinoma and in post-operative hemorrhage. It is the equal, if not the superior, of any

<sup>1</sup> Wien. klin. Wehnschr., January 7, 1915.

<sup>2</sup> Beitr. z. k. Chir., 1915, xciv, No. 2.

hitherto known hemostatic, because of its qualitative stability, the lack of any unfavorable results following its use and its prompt action.

Woltmann<sup>1</sup> reports a case of *melena neonatorum treated with transfusion by the citrate method*. The patient was a sixty-hour-old baby, and, when transfusion was resorted to, the ears were colorless, lips and finger nails cyanotic, and the child was having difficulty in breathing. The median basilic vein of the baby was raised through a small incision, and 60 c.c. of citrated blood were injected with a Record syringe and needle. The child's color was noticeably improved in both the ears and the lips, respirations were easy, and for the next two hours it slept. During the next few hours two more stools of dark blood were passed, evidently that remaining in the bowel at the time of transfusion. From that time, recovery was uneventful. The blood used in transfusing was prepared by placing in a sterile container 10 c.c. of sterile 2 per cent. sodium citrate solution and adding to that 100 c.c. of blood removed from a vein in the father's arm with a syringe and needle. The father's veins were small, and the needle introduced did not allow blood to escape rapidly enough, so a syringe was used to facilitate matters, the blood being immediately mixed with the citrate solution.

Hubbard<sup>2</sup> suggests a method of treatment in hemorrhagic disease of the newborn which eliminates the difficulties of transfusion. His method is to place blood free in the abdominal cavity. If the Kimpton tube were used, a hole in the abdominal wall only large enough to admit the canula would be necessary. The blood could be run in rapidly and there would be less danger of overflow. The hole could be closed with a stitch or two, the whole operation on the baby would require but a few moments. Less anesthesia would be necessary; the necessary exposure and the operation itself would cause certainly no greater shock than a dissection of the jugular vein; and the absorption of the free blood from the abdominal cavity would be sufficiently rapid to cure. It certainly would be as rapid as the absorption of rabbit serum from under the skin, which, in the milder cases, is curative.

Four cases of *melena neonatorum treated by horse serum* are reported by Hymanson.<sup>3</sup> The author's conclusions from this experience with these 4 cases are that the coagulation-time of the blood is somewhat delayed; and, that, since there is difficulty often in securing fresh human blood-serum, the fresh serum of the rabbit or horse will serve the purpose almost as well. In the newly born infant, when the bleeding is not spurious, the horse serum should be administered early and repeatedly until bleeding ceases. The author believes that the report of injurious effect occasionally caused by foreign serum is greatly exaggerated.

<sup>1</sup> Journal American Medical Association, December 18, 1915.

<sup>2</sup> Boston Medical and Surgical Journal, June 10, 1915.

<sup>3</sup> New York Medical Journal, June 19, 1915.

Judd<sup>1</sup> has treated severe hemorrhage in two cases of *hemophilia* by the injection of *decanted blood serum*. In both instances, the result was excellent. The technic used in securing the blood is quite simple. A donor closely related should be obtained, a healthy young adult being preferable. Examination of the blood, both as to hemoglobin and clotting should be carried out. The test for hemolysis is dispensed with. It must be borne in mind that the proportion of blood to serum is roughly five to two; that is, 100 c.c. of blood will give about 40 c.c. of serum. Such an amount of blood is taken from the cephalic or other prominent vein of the donor as will answer the need, or as the donor can spare. After drawing the blood from the vein into a clean, sterilized glass vessel, it is put into an incubator for half an hour, although this is not absolutely necessary, provided a temperature of blood heat is maintained. It is then placed on ice or in a thoroughly cool place, protected by cotton from the air until the blood separates from the clot. From one to twelve hours is required. The serum is then decanted and kept in a cool place until needed. It can be kept for several days if on ice. An ordinary glass, or metal, aspirating syringe answers the purpose of injecting admirably.

Hess<sup>2</sup> makes a preliminary report on the use of *tissue extract as a hemostatic*. For some time he has been carrying out experiments with various preparations which increase the coagulability of the blood and, which would therefore be expected to be of value in stopping hemorrhage. The most useful of these preparations has been found to be one made from tissue. At first homologous tissue was used—in the case of bleeding in human beings, human uterine tissue; more recently, however, the liver or the brain of cattle has been employed. This tissue is obtained fresh from the slaughter-house, washed thoroughly free from blood, ground up in a machine, extracted in salt solution in the refrigerator and then filtered. In its preparation aseptic precautions are observed as far as possible. The extract which contains some fine suspension of tissue, in addition to tissue juice, is made up with 0.3 per cent. of trikresol and preserved in this way. Aërobic and anærobic cultures of this fluid have been found sterile. In addition to this liquid preparation, a powder has been prepared—the tissue has been desiccated and then finely ground up in a mortar. Thromboplastic preparations treated with this small percentage of trikresol have been found to maintain their potency for at least a month. This is a distinct advantage. The difficulty has been that these preparations rapidly undergo autolysis, with the formation of antithrombic substances, rendering them not only inert, but of negative value. In human beings they have had only a very limited experience with this thromboplastin given intravenously, having as yet confined themselves mainly to its local use. Recently,

<sup>1</sup> Medical Record, New York, April 17, 1915.

<sup>2</sup> Journal American Medical Association, April 24, 1915.

it rendered most welcome service when applied locally in two cases of hemophilia. These two cases seem to establish the value of thrombo-plastin in hemophilia. It remains to be ascertained whether it will be of value in purpura, a condition so frequently confused with hemophilia, but which is not characterized by a greatly delayed coagulation time, but by a marked decrease of platelets. It has been effective in controlling hemorrhage when the blood is normal, for example, after tonsilectomy, and therefore may be found of value in checking the bleeding which so frequently disturbs the operator in the surgery of the nose, brain, abdominal organs, etc. When given intravenously, thrombo-plastin may prove to be of aid in checking various acute internal hemorrhages which are the result of ulceration or rupture of the vessel walls.

### THE THYROID GLAND.

The literature of the year on the thyroid has, as usual, been very abundant. No marked change has taken place in our views of this gland in relation to disease. A number of facts have been ascertained as to the action of the gland under experimental conditions, and some new diagnostic signs of perverted functioning have been noted.

**Experimental.** Mori<sup>1</sup> has produced artificially an inflammation of the thyroid in dogs and studied the subsequent symptoms. In some dogs, paraffin (melting point 40° to 50° C.) was injected into the thyroid, and, in others, after the same injection, the thyroid was warmed for two to three hours, or iodid of potassium was given internally. Again, calcium chloride was injected into the gland instead of the paraffin. In all cases, an inflammation of the thyroid, with subsequent thyrotoxic symptoms, was produced, and the author thinks the direct cause of the thyrotoxic symptoms was the resorption of the contents of the follicles.

In a *comparison of autoplasic and homeoplastic transplantation of thyroid tissue* into the guinea-pig, Hesselberg's<sup>2</sup> results show that for a short period of time after operation no difference is seen in the behavior of the thyroid. Very soon, however, a destruction of follicles begins to take place in the homeografts. This destruction is not caused by a direct primary disintegration or solution of follicles, but depends on the destructive activity of (1) the lymphocytes, and (2) of the connective tissue of the host. The former invade the follicles and destroy them directly; the latter grows into the homeografts in larger quantity than into the autografts. In the former, it soon becomes fibrous and hyaline; in the latter, it remains cellular. The fibrous connective tissue surrounds and compresses, and thus destroys the follicles. In some homeografts, destruction by means of lymphocytes, in others by connective tissue, preponderates. The rapidity with which the destruction

<sup>1</sup> Sei-I-Kwai Med. Jour., Tokyo, January 10, 1915.

<sup>2</sup> Journal of Experimental Medicine, February, 1915.

takes place in different homeotransplants also varies. A much better bloodvessel supply develops in the autograft than in the homeograft.

Douglas<sup>1</sup> has studied the *effects of various diets on the thyroid* in different animals. He found no characteristic appearances in the pigeon in the condition of beriberi. In pigeons fed on polished rice, the tendency is for the disappearance of colloid from the vesicles of the thyroid. These animals are, for the most part, not so well nourished as normal birds. The histological appearances do not represent different stages of secretion, comparable to those of secreting glands engaged in the process of digestion. Under similar conditions and in animals fed on similar diets, the appearances in the thyroid differ very markedly. One observes all stages from the type with large vesicles, full of colloid with flattened cells to that of a thyroid with no columnar-shaped cells. Also, the thyroid may be wholly or partially disintegrated. The variation in appearance of the thyroid, Douglas states, seems to depend to some extent on the nutrition, and is thus only in this way dependent on the diet.

Neuhof<sup>2</sup> found that uniform changes do not follow ligation of the thyroid arteries or veins. When present, they are generally not profound. Alterations in structure are more common and marked after ligation of the thyroid veins than after ligation of the arteries. Following the former there is a decrease in the size of the acini, irregularity in their shape, increase of the interstitial connective tissue and diminution in the amount of colloid. The end results, however, (after three to six months) is an increase in size and coalescence of acini, scanty interfollicular connective tissue, and diminished size and weight of the gland. A reduction in size and generalized rounding in the shape of the acini are the chief results of arterial ligation. The changes in one thyroid lobe following ligation of its veins or arteries may exist to a lesser degree in the unoperated lobe. The only symptom or sign referable to hyperthyroidism, following interference with the circulation of the thyroid lobes, consists in an acceleration of the pulse of some months' duration after ligation of the thyroid veins and retardation of the pulse of several weeks' duration after ligation of the arteries.

Malovichko<sup>3</sup> found that destructive changes could be demonstrated in the thyroid, in the form of degenerated epithelium and changes in the colloidal substance and interstitial tissue, following removal of the suprarenal glands.

A study of the *changes in the iodine-content of the thyroid* consequent upon changes in the blood flow through the gland has been made by Watts.<sup>4</sup> His results showed that the iodine percentage of the thyroid

<sup>1</sup> Journal of Pathology and Bacteriology, January, 1915.

<sup>2</sup> Journal of Medical Research, July, 1915.

<sup>3</sup> Russky Vrach., 1915, xiv, No. 23.

<sup>4</sup> American Journal of Physiology, September, 1915.

lobes in dogs is practically identical, and stimulation of the cervical sympathetic nerve or the thyroid nerves induces a decrease in iodine and water content of the thyroid glands. Stimulation of the cervical sympathetic, or the thyroid nerves, also brings about a vasoconstriction in the glands. Decrease in the blood flow through the thyroid, similar to that induced by stimulation of the above nerves but produced by mechanical means, causes a decrease in iodine and water content of the gland and the changes in the thyroid so far shown to be caused by stimulation of the cervical sympathetic or the thyroid nerves can all be accounted for by the vascular changes. No histological changes could be demonstrated following stimulation of the thyroid nerves or mechanical interference with the blood flow.

Emge<sup>1</sup> has noted the *changes in the thyroid* of the guinea-pig following an experimental diphtheria toxemia. These changes were found to be not so marked as those observed in the human gland in cases of fatal diphtheria. The changes in the guinea-pig thyroid were not sufficiently marked, nor so uniformly parenchymatous, as to permit the conclusion that this gland has a detoxicating action in experimental diphtheria toxemia.

A study of the *effect of thyroid extract on blood-pressure* has been made by Fawcett, Rogers, Rahe and Beebe.<sup>2</sup> The experiments were begun with an attempt to isolate from a watery extract of the fresh gland, all of the substances which can be separated, with as little alteration of their chemical structure as possible. These include the so-called nucleoproteins, globulins, coagulable and non-coagulable albumins, and the alcohol-soluble and alcohol-insoluble residue. Each of these bodies has been dissolved and injected intravenously in dogs, and the results on the blood-pressure, respiration, and heart action noted in the usual kymograph tracings. The solution of the alcohol-soluble residue left after removal of all other substances has been found to be the only substance which produces any appreciable effect on the blood-pressure. The glands used throughout these experiments were pig thyroids. It was found that iodine is present in all the fractions of the extract. The coagulable fractions, which are the richest of all the fractions in iodin, produce little or no depressor effect, even in relatively enormous dosage. The "residue," or fraction of the extract which remains after the removal of the coagulable fractions, contains iodin, but in smaller quantity than the other fractions. The depressor effect of the "residue" bears no relation to the total iodine-content of the gland from which the residue is derived. The depressor effect of the "residue" follows only after its intravenous injection. It is not manifested after subcutaneous injection. Tachycardia is not regularly produced by this depressor substance, although a very large dose (10 c.c.) does accelerate the

<sup>1</sup> Journal of Infectious Diseases, September, 1915.

<sup>2</sup> American Journal of Physiology, January, 1915.

pulse rate at the lowest points of blood-pressure. Later, the force and rate of the heart beat return to normal with return to normal of the blood-pressure. The active portion of the "residue" is not precipitated by basic lead acetate; is not altered by boiling nor by passage through a Berkefeld filter, and is soluble in alcohol. No immunity to the depressor effect of the "residue," or of its active portion was noted during the limit of the experiments (from four to six hours).

Experiments carried out by Marine<sup>1</sup> emphasize the extraordinary affinity of the thyroid tissue for iodine. When one considers that as high as 18.5 per cent. of a given intake of iodine by mouth may be recovered from a thyroid whose ratio to the body weight is as 1 to 687, it stands alone at present among the specific affinities of tissues for inorganic substances. The results further emphasize the fact that maximum thyroid effects are induced by minimum amounts of iodine. The amount of a given intake absorbed depends, for the most part, on the size of gland and the existing degree of hyperplasia or the degree of saturation with iodine at the time of its administration.

According to Marine and Feiss,<sup>2</sup> artificially perfused thyroids take up and retain potassium iodide to the same extent that *in vivo* perfused thyroids do. This characteristic is not shared by the liver, kidney, spleen, or muscle. The amount of potassium iodide retained is independent of its concentration in the perfusion fluid. Only surviving glands exhibit the ability of taking up potassium iodide. Potassium cyanide inhibits this activity of the thyroid. It is possible to wash out with defibrinated blood a small amount of the iodothyreoglobulin in an hour's perfusion, even in intact glands rich in iodothyreoglobulin. Autolyzing glands do not take up potassium iodide, and rapidly give up their stored iodine in the perfusate. The potassium iodide stored in a thyroid gland from one hour's perfusion, whether *in vivo* or *in vitro*, is pharmacologically inactive.

The experiments of Lenhart<sup>3</sup> show that the feeding of dried thyroid glands to tadpoles causes an early differentiation in proportion to the quantity fed, or to the percentage of iodine-content of the gland used. With the larger doses and the higher iodide percentages, metabolism is stimulated to such an extent that the animals emaciate rapidly and die early before there is time for much differentiation. With smaller amount and lower iodine percentages, the size of the animals is roughly inversely proportional to the amount or percentage, so that a close association of differentiation with pigmy size is not characteristic of thyroid feeding as such. One may see early and marked differentiation along with larger size. It all seems a matter of dosage. The important point established by the author's studies is the confirmation of what we

<sup>1</sup> Journal of Biological Chemistry, October, 1915.

<sup>2</sup> Journal of Pharmacology and Experimental Therapeutics, December, 1915.

<sup>3</sup> Journal of Experimental Medicine, December 1, 1915.

may be justified in regarding as an established fact, namely: That the activity and potency of the physiologically active substances of the thyroid is measurable in terms of its percentage iodine-content. Lenhart points out that the reaction of tadpoles to thyroid feeding is so sensitive that the procedure might well serve as a biological test for the activity of thyroid tissue superior even to chemical methods.

Sweet and Ellis<sup>1</sup> noted in two cases that complete removal of the function of the pancreas concerned in digestion is followed by marked changes in the spleen and in the thyroid apparatus. The spleen shows an extreme simple atrophy. The thyroid apparatus exhibits a constant change, shown by the macroscopic transparency of the gland, by the microscopic increase in the amount of colloid, by the chemical increase of the iodine-content of the gland, and by the functional test of the delayed appearance of tetany after the complete removal of the thyroid apparatus.

**Chemistry and Pathology.** During the past twenty years, investigation has firmly established, among other things, the following facts: the thyroid contains some substance capable of producing marked physiological effects, and iodine is a constant constituent of normal and pathological glands. These two facts are emphasized because most of the controversies concerning the thyroid have arisen from attempts to explain the relation between the physiological activity and the presence of iodine. Kendall,<sup>2</sup> by an alkaline alcoholic hydrolysis, has been able to break up the thyroid proteins into many simpler constituents. These may be separated into two groups: The acid-insoluble compounds are designated Group A; those acid-soluble, Group B. From Group A, a pure crystalline compound, containing 60 per cent. of iodine, has been isolated. It appears to be di-iododi-hydroxy-indol. Group B contains iodine in some unknown form of combination. It is a mixture containing amino-acid complexes and a low molecular weight.

Administration of A produces in the dog and in the human being a rapid increase in pulse rate and vigor, and increase in metabolism and nervous irritability. This physiological activity is produced by the compound containing iodine in all stages of purity up to, and including, its crystalline form. Given in excess, toxic symptoms are produced. The amount of the iodine compound required to produce toxic effects is exceedingly small.

In exophthalmic goitre, two abnormal conditions exist; the secreting capacity of the gland is greatly increased, and the reservoir capacity of the gland is greatly decreased. The iodine compound plays an important role in the production of the symptoms of exophthalmic goitre. The constituents of Group B produce no toxic symptoms, but, in cases of cretinism, myxedema and certain skin conditions, they exert physiological activity.

<sup>1</sup> Journal of Experimental Medicine, December 22, 1915.

<sup>2</sup> Journal American Medical Association, June 15, 1915.

Fenger's<sup>1</sup> investigations led to the conclusion that both enlarged and normal-sized human fetal thyroids contain iodine, at least during the last three months of intra-uterine life. Normal-sized fetal glands contain relatively more iodine and less phosphorus than enlarged fetal glands.

In an exhaustive study of the pathological anatomy of the thyroid gland, Rautmann<sup>2</sup> states that the thyroid gland in exophthalmic goitre seems to have reverted to an infantile type, the histological findings resembling those of a child's thyroid. The same applies also to the thymus, and the severity of the Basedow syndrome seems to be proportional to the earlier infantile character of the histological findings in the organs with an internal secretion. No pathologic-anatomic findings were encountered in any other organs in the uncomplicated cases of exophthalmic goitre, but the pathological findings in the glands with an internal secretion varied widely in intensity. The thyroid was always, and the thymus usually, involved, but only occasionally the parathyroids and the hypophysis. The suprarenals, and also the ovaries, were frequently found abnormal, and, in some cases, possibly also the islands of Langerhans. Throughout, an infantile type of structure is noticeable as the anatomic basis of Basedow's disease. The changes in the thyroid, thymus, parathyroids and hypophysis are predominantly of a hypertrophic hyperplastic nature, while in the suprarenals, ovaries and islands of Langerhans atrophic hypoplastic processes predominate. The result is excessive functioning in the first group and deficient functioning in the others. There are no signs of inflammation in the organs, while many signs point to toxic action, and to the system of glands with an internal secretion as the source of the toxin.

In a discussion of the *pathogenesis of exophthalmic goitre*, Hart<sup>3</sup> separates the cases of this disease into three groups, those of thyroid origin, those of thymus origin, and those in which thyroid and thymus are both etiologically involved. In the purely thyroid cases, the cause of disturbance in structure and functioning of the thyroid is still a mystery, but in this group the thymus is not at fault. In the second, the thymus cases, there is always a constitutional inferiority. The thymus is abnormally large, the heart and aorta system abnormally small, with hyperplasia also of the chromaffin system and genital apparatus, while the height is extreme in proportion to the weight. The mentally and morally backward (psychic infantilism) also present an abnormally large thymus, and this is also a strikingly frequent finding in youthful suicides. The thymico-lymphatic state also prepares the soil for exophthalmic goitre. The thymus is at the height of its functioning in early life, and the constitutional inferiority becomes evident then likewise. This suggests that in the third type of exophthalmic goitre,

<sup>1</sup> Journal Biological Chemistry, April, 1915.

<sup>2</sup> Mitteilungen a. d. Grenzgeb. d. Med. u. Chir., 1915, xxviii, No. 3.

<sup>3</sup> Med. Klinik, April 4, 1915.

that in which both thyroid and thymus are involved, the thymus is the primarily abnormal organ. Hart concludes that it is possible to determine by the signs of constitutional inferiority the cases in which the thymus is involved, and thus point the way to effectual operative treatment. The greater the predominance of the thymus, the severer the clinical picture, as a rule. The action of the abnormal thymus is more intensive, the more pronounced the hypoplastic character of the structure of the body. The earlier the exophthalmic goitre develops, the larger the share of the constitutional factors in its pathogenesis. The thymus type is therefore more common in the young.

**Signs and Symptoms.** Popoff<sup>1</sup> calls attention to an early *sign* of exophthalmic goitre which he considers to be a forerunner of Graefe's sign. When a patient's eye is fixed on an elevated object which is gradually lowered the eyeball and the lid normally move synchronously. In the early stage of exophthalmic goitre, however, the lid becomes very irregular in its movements; it either moves faster than the eyeball or lags behind. In some cases of the disease this lack of synchronism in the movements of the eyeball and lid is observed only at the beginning of the experiment and it disappears after repeated trials, being followed by normal synchronous movements.

Geyelin<sup>2</sup> has studied the *carbohydrate metabolism* in hyperthyroidism, as determined by examination of the blood and urine. Of the 27 cases investigated, the first twenty ranged from cases of moderate severity to severe ones, while the last seven were mild, and in one case there was some doubt as to the diagnosis. A majority of the symptoms, however, pointed to hyperthyroidism. Eighteen showed a hyperglycemia, either fasting or from two and a half to three hours after breakfast. They all showed either an alimentary or spontaneous glycosuria; in most of the cases both. And further, all those on whom the test was made showed an increase above the preexisting blood-sugar level two hours after 100 grams of glucose which was proportionally much greater than in any of the normal controls, most of whom showed a return to preformed values after this test. The alimentary glycosuria was usually quite marked, and in one patient persisted for three days. Of the mild cases, three showed distinct lowering of the carbohydrate tolerance, as shown by alimentary and spontaneous glycosuria, and in two cases there was an alimentary hyperglycemia.

A blood-sugar reading of 0.1 per cent. or over, Geyelin says is to be considered a hyperglycemia. Hyperglycemia is a common accompaniment of hyperthyroidism. In the moderate and severe types of this disease, it occurs in 90 per cent. of the cases studied. In mild cases, or during latent periods, normal blood-sugar values are commonly obtained. Glucosuria, either spontaneous or alimentary (100 grams

<sup>1</sup> Russky Vrach., 1915, xiv, No. 33.

<sup>2</sup> Archives of Internal Medicine, December, 1915.

of glucose), is an equally constant symptom, and encountered much more often than has been observed hitherto. Alimentary hyperglycemia (two hours after 100 grams of glucose) and alimentary glucosuria are found not uncommonly in the mild cases, whereas hyperglycemia (fasting or postprandial) and spontaneous glucosuria are usually absent. As compared with normal individuals, there is a slower return to fasting blood-sugar values after doses of glucose have been given. This is more marked in proportion to the severity of the case. Thyroid extract when fed to patients with myxedema, who previously showed normal blood-sugar values, produces hyperglycemia similar to that found in cases of hyperthyroidism. The diagnostic significance of lowered tolerance to carbohydrates in hyperthyroidism is of great importance. The findings of glycosuria and hyperglycemia in other pathological conditions, such as fever, alcoholism, asphyxia, neurasthenia and in the various endocrinopathies, somewhat nullifies its significance; but, if these conditions can be excluded, its presence is highly suggestive.

A discussion of hyperthyroidism from the standpoint of military medicine has been contributed by Kahane.<sup>1</sup> The author states that far too often conditions for which excessive functioning of the thyroid is responsible are mistakenly labeled hysteria, neurasthenia, neuroses or anemia, and treated futilely on this assumption. He protests against classing all disturbances from hyperthyroidism as "complete" or "incomplete types" of exophthalmic goitre. True Basedow's disease is comparatively rare, and it affects the female sex predominantly. Hyperthyroidism, on the other hand, is a very frequent condition, affecting both sexes impartially, principally young and middle-aged adults, and it has a direct interest for military medicine which cannot be said of true exophthalmic goitre. The numerous manifestations of hyperthyroidism become more distinct and understandable when we disabuse our minds completely of the abstract notion of Basedow's disease. The same reasoning applies also to the other extreme, myxedema. It is possible for the thyroid to functionate to excess and then deficiently in succession.

A number of the symptoms which are caused by abnormal thyroid functioning are often attributed to other causes. Not many think of examining the thyroid when a patient complains of accelerated heart action after comparatively slight exertion subsiding to normal in repose, loss of weight, tremor, sensations of heat, tendency to sweat and to diarrhea, restlessness and irritability. Any one of the above should suggest possible thyroid mischief. The mere look of the eyes, a kind of rigidity and brilliancy, draws the attention of the expert to the thyroid at once. With any of the above symptoms, examination of the thyroid should be a routine procedure. The action of the thyroid on the

<sup>1</sup> Wien. klin. Wchnschr., February 11, 1915.

vascular system happens through the mediation of the vaso-motor nerves; it is clear not only in the tachycardia and increased pulse after very little exertion, but also in the inability to stand caffeine and like substances. The question whether the vicissitudes of a campaign are able to elicit hyperthyroidism is as yet not decided, but there can be no doubt that they can fan into a flame a hitherto latent predisposition. This assumption is sustained by the fact that the features of a campaign are the exact opposite of the measures advocated in treatment of exophthalmic goitre, including the physical exertion, the excitement, and the free use of tea, coffee and meat. Kahane regards hyperthyroidism as capable of incapacitating for military service, and he expatiates on the importance of an early diagnosis, as under proper treatment conditions soon right themselves. He bases the diagnosis mainly on what he calls galvano-palpation: The negative electrode is fastened to some remote part of the body, and with the needle-tipped positive electrode the region of the thyroid is lightly and repeatedly touched. When the thyroid is functioning to excess, the touch of the electrode is felt intensely and the region turns very red, the color lasting a long time.

Caro,<sup>1</sup> among 600 patients in a fortress hospital, found 66 with distinctly perverted functioning of the thyroid gland, and 420 others in which the thyroid was involved in the clinical picture. In the 66 cases of actual thyrosis, as he calls it, 11 presented gastro-intestinal symptoms as the principal disturbance, and these were seen also in 64 of the group of 420. Thus gastro-intestinal disturbance was evident in one-sixth or one-seventh of all the cases. It was mostly in the form of gastralgia, loss of appetite, eructations and sometimes a desire to vomit. This is the more remarkable, Caro adds, because in the 4 among the total 600 in which there was actual gastro-intestinal disease, there were no signs of thyroid disturbance. In 34 of the group of 66, there was an unmistakable tendency to goitre, and in 245 of the group of 420 mentioned above, the thyroid could be palpated. Among the total 486 men with thyroid symptoms, he found signs of an apical process, probably of tuberculous origin in 210 cases. He warns most emphatically against iodine when there is a possible tendency to thyrosis. The predisposition to the latter rests on a congenital instability of the vaso-motor nervous system, and this in turn rests on the unstable balance of the organs with an internal secretion. The thyroid plays the leading part, as a rule, as it is so readily upset by nervous or psychic influences, infections, or fatigue. Differentiation is important because treatment should be the reverse of that ordered with organic heart disease. The latter requires rest and sparing of the heart, while the thyrotoxic cardiovascular symptoms are benefited by exercise in the open air. The leading symptom is tachycardia, with or without palpitations. It develops

<sup>1</sup> Deut. med. Wehnschr., August 19, 1915.

during exercise and rapidly subsides in repose. The heart action is lively, sometimes shaking the chest wall. This overexertion of the heart and pulse beat is characteristic, as the blood-pressure is not found high, at least when the patient is quiet, unless it is a complication.

TREATMENT. In a discussion of the treatment of Graves's disease, Weiland<sup>1</sup> analyzes his experiences for the last ten years in his service, at Kiel. He is convinced of the necessity, along with internal measures of supplementary general treatment, both physical and psychical, with a diet to influence the metabolic disturbances, and of specific treatment of the thyroid gland itself. Measures in all these directions are called for mostly in every case, from the mildest thyrotoxicosis to the severest type of exophthalmic goitre.

Disturbance from perverted thyroid functioning develops very insidiously as a rule. At first, there are symptoms of a general nervous disturbance; the temperature is normal unless there is an underlying tuberculosis. The proportion of patients restored to full earning capacity is larger under operative than under medical measures, but the latter, perseveringly applied, restores full earning capacity in a larger percentage than is generally realized. Much greater benefit can be realized if röntgenotherapy is used to supplement other measures, with or without an operation. Weiland says that he has never seen a case in which every one of the symptoms had entirely retrogressed under surgical or medical measures or both, but we are justified in calling the case cured when the patient feels strong and well, the heart behaves normally, there is no further restlessness, tremor or abnormal sweating, and full earning capacity is restored.

The first thing in treatment is to ensure physical and mental repose; a few days in bed benefit in mild cases as much as a few weeks in the severer forms. This rest should not be disturbed by dietetic or other restrictions, but should be utilized to tranquilize the patient's mind and get his help in the efforts for recovery. The treatment at this time should be the same as for nervous prostration, or convalescence from any sickness except that sedatives may be required to overcome severe motor and psychic unrest. In the milder cases, no medicines are needed unless a sedative seems to be called for, in which case valerian might be given. Arsenic is also used, but he never gives iron. The diarrhea or sweats disappear spontaneously as the general condition gets better. For several years it has been the practice at Kiel to give sodium phosphate in all cases of exophthalmic goitre, for reasons which Weiland goes over in detail, and it is regarded as an essential part of the treatment. It is given daily in doses of 3 or 4 grams in a 10 per cent. solution. Digitalis is given only under the same indications and dosage as with organic disease of the heart.

<sup>1</sup> Therapie der Gegenwart, May, 1915, lvi, No. 5.

The diet should be that of forced feeding, training the patient to chew properly and striving to tempt his appetite, making special use of carbohydrates and fat, possibly supplemented with some pancreas preparation. It is not essential to push the forced feeding to bring the weight up to normal. Local applications of cold and electricity may help the tormenting symptoms from vascular goitres. He has not had favorable results from organotherapy of exophthalmic goitre; he has been much impressed, however, with the benefit from Röntgen exposures. They can be used in all forms of exophthalmic goitre. He used hard tubes,  $3\frac{1}{2}$  ma, with 16 x as the maximal dose, fractioned at two sittings with a few days' interval, repeating this for three or four months, with two and four weeks intervening.

If the weight and strength keep running down, and the heart functioning grows worse, an operation should be recommended immediately, but otherwise not until after a thorough course of internal treatment. For operative treatment, the objective symptoms form the criterion. Weiland, in conclusion, lays great stress upon the fact that after operative treatment the patient needs medical oversight as much as after an operation for a gastric ulcer.

Boyd<sup>1</sup> has studied the *treatment of exophthalmic goitre, especially in relation to the control of protein metabolism*. He cites 4 cases, with more or less complete records of protein metabolism while the patients were under treatment. From these observations, he concludes that adrenalin chloride has no influence on the protein metabolism in Graves's disease, while in extracts of the adrenal glands we have a substance which tends to counteract the development of excessive protein metabolism which is one of the features of this affection. The third case studied showed that parathyroid gland substance may have a retarding influence on the protein metabolism, and this study supported the view that the thyroid and parathyroid are mutually antagonistic in their action. The influence, however, exerted by the parathyroid in conditions of hyperthyroidism is not great.

Constantini and Sivori<sup>2</sup> have experimented with *cytotoxic serums*, having obtained such serums for both the thyroid and suprarenals. It seems a plausible assumption that a serum endowed with a destructive action on the thyroid would aid in lessening symptoms caused by excessive functioning on the part of the thyroid. Test-tube experiments in this line gave encouraging results; mixing with 1 c.c. of the patient's serum the amount of cytotoxic serum known to neutralize the minimal lethal dose of thyroid extract, then adding one drop of an alexin and incubating for an hour, then adding the minimal lethal dose of thyroid extract and one more drop of alexin and incubating for another hour. This mixture then injected into a rabbit's vein promptly kills the

<sup>1</sup> Edinburgh Medical Journal, August, 1915.

<sup>2</sup> Riforma Medica, April, 1915.

animal if the patient in question is suffering from hyperthyroidism, while it does not harm the animal if there is hypothyroidism. The mechanism of this is explained, and the method suggested as useful for differential diagnosis.

Also, in the treatment of hyperthyroidism, the cytotoxic serum would have the effect of binding the excess of thyroid principles in the blood. Its action would thus be analogous to that of the serum of thyroidectomized animals, now often used in treatment of exophthalmic goitre. The blood of these thyroidectomized animals contains all the principles which normally are neutralized by the thyroid gland. Cytotoxic rabbit serum in treatment of exophthalmic goitre was given a trial at the clinic in 1911 in one case, but the supply of the prepared serum ran out in two weeks and the attempt was abandoned. All the evidence so far obtained speaks strongly in favor of the possible utilization of cytotoxic serums in exophthalmic goitre.

Messerli<sup>1</sup> discusses 11 cases of *goitre in young men* in the military service in Switzerland. The father of one and the mother of two others had a goitre, and some of the sisters and one of the brothers had a goitre; only three of the young men had no family history of goitre. Messerli ordered laxatives for all. Small doses were given to maintain a continuous mild purging action to keep the bacterial flora down as much as possible. The results confirm those published by MacCarrison, and by Gaylord and Plehn, all apparently advising that the drinking water had something to do with goitre, and that by mechanically sweeping out the parasites in the drinking water we can lessen the tendency to goitre. Beta-naphthol, thymol, salol, aloes, jalap, or rhubarb may also have a destructive action on the parasites, or, by keeping the ordinary flora down, the already diseased thyroid is spared injury from their toxic products. In one case the neck measured 40 cm. before treatment, and only 37.5 cm. after thirty-eight days of the laxatives. The difference in the size of the neck was 2 cm. in the others, except in one in which it was only 1 cm., and in another in which it was 4 cm. In two cases the improvement was obtained with a simple laxative without disinfecting properties, merely aloes, rhubarb and jalap.

In a later paper, the same author<sup>2</sup> says the results of treatment seem to be as striking as they were in his previous series.

Pal<sup>3</sup> found that subcutaneous injections of an extract of the infundibular part of the hypophysis cerebri had apparently no influence on the normal thyroid and on ordinary goitre, but it displayed a pronounced action on the thyroid when functioning to excess as in exophthalmic goitre. The symptoms become less, although the thyroid may increase in size under its influence. This increase was always in the vesicles

<sup>1</sup> Rev. méd. de la Suisse romande, March, 1915.

<sup>2</sup> Ibid., December, 1915.

<sup>3</sup> Deut. med. Wehnschr., December 23, 1915.

alone, suggesting that the secretion in the vesicles and the production of thyrotoxin are separate processes. The article is based on 16 cases of exophthalmic goitre and hyperthyroidism. In 3 cases the debility was so extreme that operative measures could not be considered, but the patients got so much better under the pituitary treatment that they were then successfully operated upon. Another case shows, he states, that pituitary treatment is able to arrest destructive retrogression in the excessively secreting thyroid. In this and another case related, the thyroid trouble was evidently brought on by the therapeutic use of iodine. It had been given in the last-named case for arteriosclerosis in a man, aged forty-four years, and had entailed symptoms of exophthalmic goitre. They improved under pituitary treatment, but vascular spasms developed. The treatment was stopped, but local gangrene and death from myocarditis soon followed. This case warns that special care be exercised in pituitary treatment of a weak heart with arteriosclerosis. In fact, great care must be constantly observed with pituitary treatment as the individual response to the dosage varies within extremely wide limits.

Waters<sup>1</sup> gives the results obtained by him in röntgenization of the thymus glands in Graves's disease. Sixty cases of various types of the disease, in different stages, were treated. The treatments were divided into three series with intervals varying from two to three weeks between irradiations. Six treatments were given in each series from the anterior chest wall starting in the first interspace on the right side close to the sternal margin through a portal of entry 5 cm. in diameter. Exposures were given in the majority of cases, on six successive days, in the first, second and third intercostal space along the right and left sternal margin. A number of patients received six treatments at one seance. The patients were then allowed to wait until two weeks had elapsed before beginning the second series of exposures, when they were treated in the same manner as before, and a like interval of time allowed before receiving the third or final series. Each individual irradiation consisted of a six-minute exposure given through a 1 mm. aluminum filter at a focal and pastille distance of 20 cm.

They have used the full pastille distance, that is, the same as the focal distance; and, contrary to the general rule of inverse proportions of multiplying the reading of the pastille by four, they have multiplied by two and one-half; thus we have given a dose of  $7\frac{1}{2}$  H units through each portal of entry, this constituting the erythema dose.

The author concludes that röntgenization will cure, temporarily at least, some cases of Graves's disease. It will effect an apparent cure in some cases of hyperthyroidism when other measures have failed. Intensive irradiation under strict and rigid technic has no ill effect.

<sup>1</sup> Journal of American Medical Association, April 21, 1915.

on patients with Graves's disease. From results in this and foreign clinics, evidence enough is at hand to warrant a more liberal employment of this treatment.

### PARATHYROID GLANDS.

Nearly all of the work of the year on these structures has treated of their relation to the condition of tetany.

**Experimental.** Meyer<sup>1</sup> has investigated the relations existing between the ovaries and the parathyroids. In his experiments, all of the female dogs, regardless of age, from which the parathyroid glands had been removed, died of tetany, and this condition in no case was influenced by castration. The author believes that his researches, as well as those of Purpura, Massaglia, Cléret and Gley, prove that no antagonism exists between the parathyroids and the ovaries, as assumed by Silvestri, who found that adult females escaped tetany after removal of the parathyroid if they previously had been castrated, while the tetany developed in young animals whether or not they had been previously castrated.

Experimental observations on dogs, as to the effect of acid administration on parathyroid tetany, have been carried out by Wilson, Stearns and Janney, Jr.<sup>2</sup> The protocols of their experiments show that the intravenous injections of 3.7M or 7M hydrochloric acid solution relieved parathyroid tetany in dogs. The period elapsing before the return of the symptoms varied somewhat according to the amount of acid introduced, but in some cases extended over several days. They purposely used acid of considerable strength in order to keep the volume of liquid injected at a minimum. The injection of acid in salt solution apparently decreased the tendency toward harmful effects, as they had more evident reactions by introducing hydrochloric acid in pure water than in salt solution. The injection of 100 c.c. of a 7M solution of sodium chloride alone has no apparent beneficial effect, a fact which has been observed by others as well as by the authors.

In support of the evidence offered by an acid injection, they have observed relief in several cases when acid was introduced by mouth. The difficulties of these procedures, however, render it of uncertain value. The stomachs of most dogs in tetany are so sensitive that no material can be retained. They were fortunate, however, to obtain one animal which, by careful manipulation, retained most of the acid introduced and during the period of ingestion (five days) showed no typical tetany. The symptoms became acute later when sodium bicarbonate was given.

<sup>1</sup> Beitr. z. klin. Chir., 1915, xciv, No. 2.

<sup>2</sup> Journal of Biological Chemistry, May, 1915.

The relief of parathyroid tetany by the administration of acids suggests the possibility of a beneficial action due to a variation in the acid-base equilibria in the body, and offers a new point of view for the study of this and allied conditions.

In connection with this work, it is interesting to note the work of Greenwald<sup>1</sup> who found that after parathyroidectomy the blood serum showed a decided increase in its acid-soluble phosphorus content.

The same authors, Wilson, Stearns and Janney, Jr.,<sup>2</sup> found that after parathyroidectomy in dogs, there is usually a sudden diminution in the excretion of acids and ammonia, and a decrease in the ammonia ratio and the hydrogen-ion concentration of the urine. With the development of tetany, the elimination of acids and ammonia increases, accompanied by increased values of the ammonia ratio and the hydrogen-ion concentration of the urine. These variations, the authors believe, may indicate that an alkalosis condition results after parathyroidectomy, but is neutralized by the tetany which develops. After acute or chronic tetany, an acidosis may occur.

**Tetany.** Fletcher<sup>3</sup> has studied a case of infantile tetany in a male, aged thirteen and a half months. The clinical observations would not warrant the conclusion that calcium changes alone account for the nerve irritability in tetany, but would seem to support the hypothesis that the tetany results from a disturbance of the concentration equilibrium of the salts. Such salt changes are probably associated with gastro-intestinal disturbances and decreased activity of the kidney, and as improvement in the function of these two systems occurs, restoration of the normal salt equilibrium ensues. Treatment, accordingly, from these indications, should aim at restoring a normal digestion and increasing the activity of the kidney.

Brown and Fletcher,<sup>4</sup> after an extensive review of the literature, found that there is little uniformity of opinion as regards the etiology of tetany. Most authors who have written on the subject have associated the disturbance with a lack of calcium in the system, and only one author has suggested the possibility of a general salt disturbance; he has cited no definite proof. Metabolism observations on patients suffering from diarrhea reveals the fact that in severe water loss through the bowel, the output of sodium to potassium is eight to ten times the normal.

The production of tetany is probably due to the fact that the organism has been storing up fluid in the tissues, which fluid is in combination with sodium and potassium salts. This phenomenon is brought about by the feeding of improper food, composed of high carbohydrates, which have

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1915, p. 376.

<sup>2</sup> Journal of Biological Chemistry, November, 1915.

<sup>3</sup> Archives of Internal Medicine, September, 1915.

<sup>4</sup> American Journal of Diseases of Children, November, 1915.

been subjected to heat. The association of fluid retention with gastro-intestinal disturbance (constipation) is seen not infrequently in children, and the former seems to depend directly on the gastro-intestinal disturbances, since observations have shown that it can be controlled by dietetic changes, and disappears as the digestion improves.

Apparently the sodium chloride estimation in the urine is an index of the irritability, and, as the kidney function improves, the irritability lessens or disappears. The production of diuresis is a much severer measure of elimination than that of purgation. Undoubtedly, calcium changes alone do not account for the nerve irritability in tetany, but would seem to support the hypothesis that the tetany results from a disturbance of the concentration equilibrium of the salts, and such salt changes are probably associated with gastro-intestinal disturbances and decreased flow of urine, and, as improvement in the function of these two systems occurs, restoration of the normal salt equilibrium ensues.

The authors' conclusions are based upon observations made in 30 cases of definite tetany, and 100 infants, thought to be free from tetany. They were carefully tested electrically and mechanically for any evidence of spasmophilia. They found that tetany may be produced by high carbohydrate foods which have been subjected to heat up to, or over, the boiling point. The monthly incidence of tetany is possibly due to a disturbance of the gastro-intestinal tract (constipation), decreased internal combustion, and the comparative safety from diarrhea in feeding carbohydrate foods during the cold months. A diagnosis of tetany is suggested when there is manifest kidney inactivity in constipated infants fed upon heated foods of high carbohydrate content. As a result of this improper feeding, a disturbance of the body salts is produced. At the height of the disease there is an almost complete retention of sodium and potassium (the irritating salts), and a great loss of magnesium. As improvement ensues, there is an increased flow of urine accompanied by a relief of the constipation, during which the stored-up sodium and potassium are rapidly lost. This salt disturbance may be remedied (1) by purgation; (2) by diuresis; (3) by the administration of cod liver oil and phosphorus to build up the calcium content and (4) by a change of diet. The severe spasms may be temporarily relieved by subcutaneous injections of a solution of magnesium sulphate.

Reports of cases of tetany following thyroid and parathyroid operations are made by Sandelin<sup>1</sup> and Johnston and Budd,<sup>2</sup> and a case of chronic tetany associated with gastro-intestinal disturbances is reported by Monroe.<sup>3</sup>

A case of tetany occurring in a young man is reported by Rossiysky.<sup>4</sup>

<sup>1</sup> Finska Lakaresällskapets Handlingar, 1915, lvii, No. 2.

<sup>2</sup> Southern Medical Journal, February, 1915.

<sup>3</sup> Journal of American Medical Association, August 14, 1915.

<sup>4</sup> Russky Vrach, 1915, xiv, No. 37.

Complete recovery was brought about through the administration of parathyroid extract, hypodermically. Two cubic centimeters of the extract were given as a dose, and altogether 35 injections were made. The subjective condition improved notably, and the objective signs, which were very pronounced before treatment was begun, disappeared completely.

Tumors of the parathyroid glands are discussed by Harwitz.<sup>1</sup> He reviews the literature and reports three interesting cases; the first occurring in a woman, aged twenty-six years, in whom chronic nephritis developed after the birth of her fourth child. Six months later typical osteomalacia made its appearance, and, finally, a cheesy, tuberculous pneumonia caused the woman's death about one and one-half years after the first symptoms of osteomalacia. Oophorectomy during the last stages of the disease gave no relief.

The autopsy, in addition to confirming the above clinical findings, revealed a very soft, grayish, yellow tumor of one of the parathyroids.

The second case occurred in a child about one year old who suffered from universal ichthyosis and died in convulsions. The autopsy revealed internal hyperemia of the brain and membranes, distinct evidence of old rickets and hyperplasia of the lymphatic tissues with an enlarged thymus. There was a marked hyperplasia of the parathyroids, which were composed of an unusually large number of epithelial cells, polyhedral in shape and having small nuclei, which showed no marked affinity for acid stains.

The author states that the observations on cases of osteomalacia and rickets support, to a certain extent, the theory that the parathyroids have some significance in the pathogenesis of these diseases, but in what manner and to what extent remains a question.

The third case reported by Harwitz occurred in a man, aged seventy-five years, a carpenter by occupation. The patient suffered from paralysis agitans beginning eight or ten years ago. The postmortem examination revealed multiple, symmetrical adenomata of the parathyroid glands. In discussing the findings of other observers, and in considering the findings in this case, the author thinks it can scarcely be said that the theory that pathological changes in the parathyroid are of significance in the pathogenesis of paralysis agitans is substantiated by demonstrable anatomical changes, such as the atrophic signs of chronic inflammatory changes of the thyroid in myxedema, and, as a rule, in cretinism. Usually there have been found normal or hyperplastic glands, and this case of multiple adenomata in the four glands would seem rather to indicate a hyperfunction—hyperparathyroidism—than a hypofunction of the glands in paralysis agitans.

(In connection with the problem of the relation of the parathyroids to paralysis agitans see PROGRESSIVE MEDICINE, June, 1915.)

<sup>1</sup> Journal of Medical Research, July, 1915.

### THYMUS GLAND.

**Anatomy.** In a study of the development of the thymus gland in the pig, Badertscher<sup>1</sup> found that this gland has an ectodermal-entodermal origin. The respective origin of each segment is as follows: (1) The superficial thymus, which is a derivative of the cervical vesicle, has a purely ectodermal origin. It is a constant structure, and, therefore, forms an integral part of the organ. The connecting band is also a derivative of the cervical vesicle, and has, therefore, a purely ectodermal origin. In the majority of embryos, it persists to birth, but may be absent either on one or on both sides. The thymus head, in which is lodged the parathyroid III, is formed by a fusion of a portion of the cervical vesicle to the anterior end of the epithelial diverticulum derived from the third pharyngeal pouch. It has, therefore, an ectodermal-entodermal origin. The intermediary and cervicothoracic cords, and the midecervical and thoracic segments are derived wholly from the epithelial diverticulum of the third pharyngeal pouch, and have, therefore, a purely entodermal origin.

The lymphocytes first present in the thymus, Badertscher found, are all large lymphocytes and have migrated into it from the mesenchyme. The numerous small round cells of the thymus are formed by the repeated division of the large lymphocytes which thus become small, and also by their own proliferation. Judging from the source and structure of the small round cells, they are small lymphocytes and are identical with the small lymphocytes of the blood. The thymus may well be considered as a source of some of the small lymphocytes found in the circulating blood. The reticulum of the thymus is of epithelial origin, and is formed passively by its meshes becoming filled with lymphocytes which further separate the nodal nuclei, and thus greatly attenuate the protoplasmic processes of the syncytium. The Hassall's corpuscles are of epithelial origin. The free red blood cells and the eosinophile cells, found in both interlobular septa and the thymic lobules, are derived from lymphocytes *in situ*.

Whether or not any of the erythrocytes formed in the thymus enter the circulating blood, Badertscher says, is difficult to determine in fixed material. Some of the free erythrocytes undoubtedly undergo degeneration, and the products of disintegration of those existing in the form of eosinophile granules are taken up by the lymphocytes which thus become transformed into eosinophile leukocytes. The histogenesis of the thymus is divided into epochs, each of which is characterized by more or less distinct development features. They are: The purely epithelial epoch which extends from its origin as an outpocketing from the third pharyngeal pouch and the formation of the cervical vesicle

<sup>1</sup> American Journal of Anatomy, March and May, 1915.

to the appearance of the first lymphocytes in the thymus. The epoch of lymphocyte infiltration and lymphocyte proliferation and the formation of the reticulum. The epoch of the formation of red blood cells and the development of granular cells.

Fenger<sup>1</sup> has found that fetuses and young growing animals contain very much more thymus tissue per unit of body weight than fully mature animals. The fetal thymus is unusually rich in blood and contains nuclein bodies and phosphates in amounts equal to those found in the glands from young growing animals, indicating that the gland is active therapeutically at least three months before maturity of the fetus. Thymus glands from full-grown animals also contain nuclein bodies and phosphates, indicating that the gland does not completely cease its systemic activity during the reproductive period of these animals. Adult cattle and sheep (herbivora) contain more thymus tissue per unit of body weight than adult hogs (omnivora).

**Experimental.** Tongu<sup>2</sup> has carried out transplantation experiments on 20 dogs and 50 rabbits. Many of these animals died immediately or soon after operation from infection or from weakness. The transplanted thymus in these animals had either been absorbed or had decayed, especially in the centre. In only three dogs and eight rabbits were the results conclusive. They showed apparently that the most favorable location for autoplastic transplantation of thymus tissue is the peritoneal cavity. Implants in the spleen, under the skin or peritoneum, and between the abdominal muscles were resorbed more rapidly. The thymus tissue never showed signs of regeneration, but displayed a tendency to atrophy. In some of the animals it persisted as long as two months, in the mesentery region, showing merely slight atrophy.

Williams and Crowell<sup>3</sup> record some observations made in the course of other work as to the atrophy of the thymus in cases of beriberi. In four beriberic pigeons which had been fed on white rice, the thymus had completely disappeared in every case. Examining 16 chickens in which polyneuritis had developed as a result of a white rice diet, it was found that the thymus had completely disappeared in 7 cases, was considerably atrophied in 5 other cases, and apparently was slightly, if at all, changed in the other 4. That this atrophy is not caused simply by the age of the birds is shown by the fact that it happened in half-grown as well as full-grown fowls. No relationship could be established between the atrophy of the thymus and the length of the incubation period or the duration, severity or specific symptoms of the disease. Four chickens which had been fed on milk and white rice for varying periods in the course of another experiment were examined after death. These chickens showed signs of neuritis and were killed. Their sciatic

<sup>1</sup> Journal of Biological Chemistry, February, 1915.

<sup>2</sup> Mitteilungen a. d. med. Fakultät der k. Univ. Tokyo, 1915, xiv, No. 2.

<sup>3</sup> Philippine Journal of Science, March, 1915.

nerves showed microscopic evidences of degeneration in Marchi preparations. The thymus of one fed with autoclaved milk and white rice was small. The thymus glands of the other three chickens which were fed on whole fresh milk and white rice were large.

Two fowls were fed on white rice with an addition of 10 mg. of dried sheep's thymus daily. It was calculated that the quantity of thymus tissue ingested during the normal period of incubation would be the same as that normally present in young fowls. This small amount of tissue noticeably retarded, but did not prevent, the onset of the disease. Two fowls were fed on white rice with a daily dose of the alcoholic extract of 1.5 grams thymus gland. Here again the protection was not complete, although the loss in weight and the onset of the disease were retarded. Two fowls were fed in the same manner, but with a daily dose of the extract of 3 grams of thymus with less protective results. For comparison, two fowls were fed on white rice and 2 mg. of uracil daily. One contracted chicken cholera, the other was apparently partially protected by the uracil. Five fowls suffering from polyneuritis were treated with hydrolyzed extract of thymus gland in doses of from 5 to 50 grains of the gland. No cures were obtained. Two human cases of beriberi were treated with small quantities of thymus, and a slight improvement was seen in each case. This improvement did not last after the first few days of treatment, and the patients at the close of the treatment still showed the characteristic symptoms of the disease, although in a less distressing form. The dose was 0.3 gram of dried sheep's thymus six times daily. No change was made in the diet of the patients.

Dock<sup>1</sup> and Reede<sup>2</sup> both give excellent and comprehensive reviews of our present knowledge of the thymus gland. Neither of these papers is suited to abstracting.

**Diagnosis.** A sign diagnostic of hyperplastic thymus is described by Houghton.<sup>3</sup> He found that delicate shadows corresponding to the lateral borders of the thymus and the shadows internal, move outward and inward with each cardiac systole and diastole. In uncomplicated cases, there is no movement with respiration even when a deep breath is taken. On the contrary, shadows which represent the bronchial tree move upward and downward with each inspiration and expiration and show only slight cardiac movement in the immediate neighborhood of the lung roots.

Possible sources of error should be kept in mind as follows:

A hyperplastic third or inferior lobe of the thyroid sometimes occupies a position in the critical space of Grawitz. He has not seen such a case, but, on theoretical grounds, believes that the shadow would be more

<sup>1</sup> Ohio State Medical Journal, September, 1915.

<sup>2</sup> Washington Medical Annals, July, 1915.

<sup>3</sup> Journal of American Medical Association, July 24, 1915.

dense than that of a thymus persistans. It should not be forgotten that at least 90 per cent. of enlarged thyroids are accompanied by hyperplastic thymus glands. The shadow of a thyroid lobe in this position should rise and fall in the act of swallowing.

The absence of a characteristic thymus shadow does not exclude the presence of an enlarged thymus. Hyperplastic thymus tissue sometimes extends from the base of the tongue to the apex of the heart. It may hide behind the sternum, enlargement having taken place in an antero-posterior direction (Halsted).

A thymus shadow may be cast by the fat which replaces the lymphoid tissue during the normal involution of that gland. It appears doubtful if this could cause confusion to the extent of a positive error in diagnosis. It should not be forgotten that hyperthymization (Svehla) may possibly arise from a very small and insignificant persisting remnant, the presence of which could not be directly diagnosticated by any method now available.

The differential diagnosis between thymus hyperplasia and mediastinal tumors presents no unusual difficulties. The appearance of pressure on the bronchial tree is conclusive. The obstruction which blood presents to the passage of the Röntgen ray gives a characteristic appearance to aortic aneurysms.

**Relation to Exophthalmic Goitre.** Nordmann<sup>1</sup> was unable to detect any influence on the growth or development in any way of dogs thyomectomized soon after birth. His evidence is all against the assumption that the thymus is a vitally necessary organ. On the other hand, when the thymus is unduly enlarged and probably hyperfunctioning, it is liable to set up or aggravate exophthalmic goitre. He operated on the thyroid for exophthalmic goitre in 18 patients, and 3 died during the operation, and in all of these, a man, aged forty-eight years, and two women, aged twenty-eight and twenty-three, the thymus was found unusually large for their age. The others were all cured by the operation of the thyroid. In some cases everything seems to incriminate the thymus as the cause of exophthalmic goitre. In any event the thymus should be investigated in every case, and if it seems practically normal while the symptoms are severe, the thymus is probably at fault. It should be resected if unduly large for the age. If not enlarged, the intervention had better be restricted to simple ligation of the vessels at the poles of the thyroid. If no improvement follows this in the course of months, resection of the thyroid should be advocated. When the exophthalmic goitre is of purely thymic origin, the patients seem to be unable to stand the simplest operative procedures, not even ligation of the vessels of the thyroid under local or general anesthesia. The operation in itself and the shock seem to be the cause of death with persisting

<sup>1</sup> Arch. f. klin. Chir., 1915, cxi, No. 1.

thymus, and yet one of the patients in his group with fatal outcome had passed through an operation for ruptured tubal pregnancy without harm two years before. It is possible that the operation on the thyroid causes the production of certain fatally poisonous substances. It is certainly noteworthy that some of these patients had had operation done on the thymus without harm; the thyroid had been left unmolested, however.

### THE ADRENAL GLANDS.

**Experimental Researches.** Crowe and Wislocki<sup>1</sup> have carried out extensive experiments on the suprarenals with the idea especially of determining the *function of the interrenal portion*. Their results led them to the following conclusions: In dogs, the adrenals are organs which are essential to life, and it is probably the cortex and not the medulla which is the essential portion. After partial extirpation of the glands, the portion left behind undergoes hypertrophic changes. The hypertrophy is due to an increase and growth of the cortex, especially the zona fasciculata. The medulla undergoes no compensatory hypertrophy. Chronic infections occurring in animals with adrenal insufficiency are associated with an interstitial fibrosis and destruction of the cells of the zona fasciculata in the cortex. Acute general infections in animals with adrenal insufficiency in some cases give rise to necrotic foci, without hemorrhage, in the zona fasciculata of the cortex of that portion of the gland which has been left intact.

In none of the authors' cases was either hemorrhage or destruction of cells noted in the medulla as a result of either acute or chronic infections. After nearly complete removal of both adrenals, the animals often developed general convulsions, subnormal temperature and other symptoms of an acute adrenal insufficiency. In some cases the animal, after these symptoms, recovers, and develops in a normal way, so far as growth and sex functions are concerned. The temperament is not changed. An increase in weight takes place, but not to an abnormal degree. Polyuria does not occur. As a consequence of renal insufficiency no permanent increase or decrease in the carbohydrate metabolism takes place. A transitory glycosuria follows the operative procedure, whether it be on the right or left adrenal. An autoplastic transplant may heal, but is of no functional worth. If a portion of adrenal consisting of medulla and cortex is transplanted, the cells of the cortex persist, but the medulla cells are absorbed. There seems to exist a definite relation or dependence between the adrenals and the lymph system. The most striking postmortem finding in an animal with adrenal insufficiency of long duration is the increase in size of the mesenteric and retroperitoneal glands, and of the solitary follicles in the intestinal wall. Often there is also a hyperplasia of the thymus.

<sup>1</sup> Beitr. z. klin. Chir., December, 1915.

Friedman<sup>1</sup> has studied the *influence of removal of the suprarenals and one-sided thyroidectomy on the gastric and duodenal mucosa.* His experiments show that suprarenal hypofunction causes lesions in the stomach in rabbits and in dogs. An excess of thyroid gland, as produced by repeated intravenous injections, was probably responsible for the gastric lesions of two dogs and one rabbit (of four animals experimented on). Thyroid hypofunction caused the appearance of duodenal lesions in five animals out of six. An excess of adrenalin, produced by repeated injections of the drug, led to the appearance of lesions in the duodenum of dogs. The simultaneous production of suprarenal and thyroid hypofunction did not lead to any lesions in the stomach, nor in the duodenum in rabbits. When, after the removal of one suprarenal, the other became hypertrophied, lesions were seen in both viscera of three rabbits and in the duodenum of one. From Friedman's experiments, it seems probable that gastric lesions might be dependent on suprarenal insufficiency as well as on an excess of thyroid gland, duodenal lesions, on the contrary, on thyroid hypofunction as well as on excess of adrenalin. Gastric and duodenal lesions might be dependent on the alternating effect of hypofunction and hyperfunction of the suprarenals.

The effects of *epinephrin infusions on vasomotor irritability* have been noted by Hoskins and Rowley.<sup>2</sup> Their experiments were carried out on 44 dogs. The vasomotor mechanism was stimulated by faradization of the sciatic and splanchnic nerves, and by injections of nicotine, epinephrine, and pituitary extract, before, during, and after, intravenous infusion with epinephrine. No concentration of epinephrine gave satisfactory evidence of augmenting vasomotor irritability, or facilitating the transmission of vasomotor impulses. In most instances the infusion lessened the vasomotor irritability—sometimes to a marked degree. The animal's own suprarenal glands played no significant part in the results. The irritability of both the pressor and depressor mechanisms was probably both central and peripheral, hence circulating epinephrin is probably not a factor in the ordinary functioning of the animal economy.

Experiments have been carried out by Richards and Wood<sup>3</sup> which show that the intravenous injection of strophanthin into dogs and cats is regularly followed by the development in the blood of capacity to cause decrease of tonus and inhibition of contractions in an isolated strip of intestinal muscle in a manner indistinguishable from that possessed by the epinephrin. This finding is not noted after section of the splanchnic nerves or of the spinal cord between the fourth and fifth cervical nerves. This is evidence that strophanthin is able to stimulate the central nervous mechanism controlling the secretion of the suprarenal

<sup>1</sup> Journal of Medical Research, May, 1915.

<sup>2</sup> American Journal of Physiology, June, 1915.

<sup>3</sup> Journal of Pharmacology and Experimental Therapeutics, January, 1915.

glands. Experiments are also described which show that digitoxin has the same capacity in a high degree; but that strychnine and camphor are decidedly less active.

The same authors<sup>1</sup> are convinced that the processes in the suprarenal gland which are responsible for the discharge of epinephrin into the blood are subject to reflex inhibition by way of the depressor nerves; in a word, the mechanism of suprarenal secretion is involved, not only in pressor, but in depressor reflexes.

Brown and Pearce<sup>2</sup> have observed the *pathologic action of arsenicals on the suprarenal glands*. They found that toxic doses of all arsenicals produced definite pathological changes in the suprarenals of guinea-pigs. These changes include congestion, hemorrhage, disturbances in the lipoid content, cellular degenerations and necroses, and reduction in the chromaffin content. The character and severity of the injury produced by different arsenicals varies with the chemical constitution of the compounds. On account of these facts, Brown and Pearce believe that suprarenal injury is an important factor in arsenical intoxication, and suggest that therapeutic doses of some arsenicals may produce suprarenal stimulation.

Investigations carried on by Verdozzi<sup>3</sup> as to the *relation of the suprarenal capsules to lactation* show that the cortical substance of the suprarenals increased regularly in size and weight during lactation. This occurs so often, he says, that we are justified in accepting it as the general rule in mammals, and hence can assume that the cortex of the suprarenals represents an important factor in the development and general nutrition of the animal organism.

Van den Bergh<sup>4</sup> discusses *hypernephroma and precocious sexual characters*. He describes a case of hypernephroma in a girl, aged three years. A large, hard retroperitoneal tumor could be felt in the left abdomen. The condition was accompanied by fever and progressive weakness. The child was four or five inches taller than the average, and its general aspect suggested the appearance of an adult; the adult character in the external genital organs was especially noticeable. The skin was normal the eye grounds were normal and likewise the skull findings. There was nothing to suggest precocious functioning of the sexual organs. On the strength of these findings a diagnosis of left hypernephroma was made, and the removal of the tumor attempted, although the dangers of such a procedure were realized. After removal, the tumor was found to weigh 2000 grams and measured 22 x 16 x 12 cm. Apparently, there was a metastasis in the stump of one or more veins.

<sup>1</sup> American Journal of Physiology, November, 1915.

<sup>2</sup> Journal of Experimental Medicine, November, 1915.

<sup>3</sup> Policlinico, November, 1915.

<sup>4</sup> Nederlandsch Tijdschrift voor Verloskunde en Gynaecologie, November 13, 1915.

A paper by Williams<sup>1</sup> appears under the title of "Hypoadrenia, Mislabelled Neurasthenia." The author states that besides the extreme insufficiency shown in Addison's disease, there are many degrees of insufficiency shown by the adrenal glands, and that we are now beginning to comprehend that many symptoms long observed heretofore are due to adrenal lesions causing reduction in the quantity of gland secretion, and hence hypoadrenia. The term neurasthenia the author holds amounts to nothing more than a convenient cloak for failure to investigate the case sufficiently. Hypoadrenia may result from the wasting of old age, the toxins of the infectious diseases, hemorrhages in the substance of the gland, due to high blood-pressure, or perhaps from exhaustion by long-standing emotions. We know something of the pathology of this state, but no one ever knew of a satisfactory pathology of neurasthenia. The symptoms of hypoadrenia stand out clearly which never could be said of neurasthenia. The author enumerates a number of interesting cases to illustrate this condition, and his object, he says, has been to show by these instances that when we are confronted with patients who have great asthenia, lack of concentration, and more or less of the long list of symptoms heretofore assigned to neurasthenia, we must not be content to stop with the latter as a diagnosis. If, in addition, there are low blood-pressure, subnormal temperature, pigmentary changes, hypoadrenia may be the cause of the depression.

#### THE PINEAL GLAND.

**Experimental Research.** Dandy<sup>2</sup> has carried out extensive experiments to determine the effects of extirpation of the pineal body. Following the removal of the pineal, no sexual precocity or indolence were observed, no adiposity or emaciation, no somatic or mental precocity or retardation. His experiments seem to have yielded nothing to sustain the view that the pineal gland has an active endocrine function of importance either in very young or adult dogs. The pineal is apparently not essential to life, and seems to have no influence on the animal's well-being.

Continuing his work of last year,<sup>3</sup> McCord<sup>4</sup> has carried out further experiments, the results of which show that evidence of the precocity of development usually attributed to pineal deficiency (hypopinealism) has been obtained in animals by supplying an increased amount of pineal substance through feeding or injecting pineal preparations. Such administration of pineal substances led to a more rapid growth of body than normal, and determined an early sexual maturity. The excess in rate of growth was most pronounced (40.9 per cent. excess in eleven

<sup>1</sup> Archives of Diagnosis, October, 1915.

<sup>2</sup> Journal of Experimental Medicine, August, 1915.

<sup>3</sup> PROGRESSIVE MEDICINE, June, 1915, p. 389.

<sup>4</sup> Journal of American Medical Association, August 7, 1915.

weeks) in *young* animals fed with pineal tissue obtained from *young* animals. No tendency to gigantism has followed pineal administration. After maximum size was attained, pineal administration appeared to be ineffective. Both males and females respond to the influence of pineal substances in rate of growth, but the response has been more definitely manifested in males.

Clark<sup>1</sup> has studied *the effect of pituitary substance on the egg production of domestic fowls*. The results show that feeding of pituitary gland substance (anterior lobe) increased the egg production of hens whose production curve was on the decline. The dosage was effective on the fourth day after the first dose and lasted for several days after the last dose. The hatchability of eggs from dosed parents was increased.

Weed and Cushing<sup>2</sup> have investigated *the effect of pituitary extract on the secretion of cerebrospinal fluid*. Extracts of the posterior lobe of the hypophysis introduced intravenously served to discharge cerebrospinal fluid from a calibrated catheter introduced in its pathway (ventricle or subarachnoid cistern). Positive responses occurred to the injection of nearly all the fluid proprietary preparations, though in the author's hands the desiccated extracts have proved to be the more active. The possible increment to the fluid through increased permeability of the cerebral capillaries and drainage out along the perivascular lymphatics was excluded in most of their experiments by the method of tapping the fluid pathway in the third ventricle rather than in the cisterna magna. The response occurred under most variable conditions, and appeared to be independent of respiratory influences or hemodynamic reactions, for it may coincide with periods of respiratory cessation or acceleration or with periods of arterial hypertension or depression. A prolonged flow from the ventricle may continue even after death, and may reach an amount apparently in excess of the normal content of the ventricles. That there is an actual increase in the amount of fluid secretion was shown by its non-recession into the cannula following periods of increased cerebral vascularity, as well as by the measurement of the amounts discharged. The evidence inclines Weed and Cushing to believe that the outflow under the circumstances of their experiments represents an actual secretory response rather than an expulsion of preformed fluid due to physical conditions resulting in changes in the volume of the brain. Hence their conclusion may be justified that extracts of the posterior lobe of the hypophysis increase the rate of production of cerebrospinal fluid (choroidorrhea) by stimulating the secretory activity of the choroid plexuses.

Simpson and Hill<sup>3</sup> have noted *the effect of repeated doses of pituitrin on the secretion of milk*. The administration of pituitrin extract, by intravenous, intramuscular or subcutaneous injection, to a lactating

<sup>1</sup> Journal of Biological Chemistry, October, 1915.

<sup>2</sup> American Journal of Physiology, January, 1915.

<sup>3</sup> Ibid., February, 1915.

animal led to a marked increase in the quantity of milk secreted and also in its fat content. In the goat, if the injection were continued at intervals over a long period—several months—immunity to its action on the mammary glands appeared to be established, both in regard to the amount of milk yielded and the percentage of fat it contains.

*The influence of the extract of the posterior lobe of the hypophysis on the secretion of saliva* has been studied by Solem and Lommen.<sup>1</sup> In their experiments, pituitary extract invariably caused a diminution in flow of blood and saliva from the submaxillary gland, as shown from results obtained from thirty dogs and one cat. The decrease in flow of saliva was greater than the accompanying decrease in blood flow. The slowing of blood was less marked if the injection were made during faradization of the chorda tympani than during pilocarpin stimulation, while the slowing of saliva was the same. Pilocarpin was relatively ineffective, even when injected seven or eight minutes after pituitary extract. While epinephrin normally caused a vasodilatation of the gland and increase in salivary secretion, epinephrine during the action of pituitary extract had the normal effect on the blood flow but caused a diminution in salivary flow, probably due to the greater quantity of pituitary extract coming in contact with the gland. When pituitary extract was injected during the action of chrysotoxin, the decrease in the flow of saliva set in before the vasoconstriction in the gland occurred. In 5 out of 7 cases, the flow of saliva slowed, while there was active vasodilatation in the gland. From these results the authors conclude that the decrease in flow of saliva following the injection of pituitary extract is due to inhibition of the action of the secretory nerves to the submaxillary gland, but also due in part to the accompanying vasoconstriction, which is caused by direct action on the muscles of the arterioles or the effect on the peripheral endings of the vasomotor nerves, but more probably to the effect on both. The decrease in output of blood from the gland may be also due to the decreased activity of the gland.

Robertson and Burnet<sup>2</sup> have found that the administration of emulsions of the anterior lobe of ox pituitary increased very markedly the rate of growth of the primary tumor in rats inoculated with carcinoma. The growth of small tumors was accelerated relatively more than that of large tumors. This acceleration was only evidenced, however, at a certain stage in the growth of the tumor, subsequent to the twentieth day succeeding inoculation. The administrations did not enhance the tendency of the tumors to metastasize. Liver emulsion did not cause an acceleration of the growth of carcinoma in rats.

Keeton and Becht<sup>3</sup> have noted the effects of electrical stimulation of the hypophysis in dogs. Their results showed that if precautions be

<sup>1</sup> American Journal of Physiology, September, 1915.

<sup>2</sup> Journal of Experimental Medicine, March, 1915.

<sup>3</sup> American Journal of Physiology, November, 1915.

taken to avoid asphyxia, an animal may be anesthetized with ether without causing a marked rise in the reducing power of the blood. Such a level once established, not only does not tend to increase but generally falls under one to three hours of insufflation anesthesia. Electrical stimulation of the hypophysis in dogs under insufflation anesthesia gives rise to an increase of the reducing substance in the blood. Drilling under the sella stimulates the gland mechanically, but not so efficiently as induced shocks. If the stimulation be applied anteriorly or posteriorly to the gland, with precautions to prevent an escape of the current to the hypophysis, no rise in the reducing substance takes place. This rise on stimulating the gland does not occur in dogs whose splanchnic nerves have been previously sectioned, a fact which argues against the liberation of a hormone which increases directly the cellular glycogenolysis. With active diuresis, the threshold of glycosuria lies between 0.190 per cent. and 0.21 per cent. reducing power of the blood figures in dextrose. Once established, the sugar in the urine increases in concentration out of proportion to the reducing power of the blood.

**Chemistry and Physiology.** Physiological reactions characteristic of extracts of pituitary and suprarenal glands were obtained by McCord<sup>1</sup> from bovine fetal glands during all developmental stages in which the macroscopic recognition of the glands is possible. For the pituitary gland this period is from the eighth week to full term; for the suprarenals the period is from the sixth week to full term. The presence of the active principles of these glands at so early a developmental period suggests that the fetus *in utero* may be under the influence of its own internal secreting glands as well as the maternal glands.

In a study of the *composition and physiological activity of the pituitary body* of hogs and cattle, Fenger<sup>2</sup> found that the posterior lobe of the pituitary body of the hog is twice as large in proportion to the weight of the entire gland as that in cattle. The physiological activity of the posterior lobe, when determined according to the isolated uterus method, is practically the same for cattle (herbivora) as for hogs (omnivora). No distinct seasonal association in activity and chemical composition of the posterior lobe of the pituitary body exists in cattle. Approximately 10 per cent. of beef glands contain colloid mostly secreted between the anterior and posterior lobes. This material is insoluble in acidulated water and does not possess any pronounced uterine contracting power.

**Pathology and Physiology.** Cushing and Goetsch<sup>3</sup> have noted that a train of symptoms, coupled with retardation of tissue metabolism and with inactivity of the reproductive glands, not only accompanies states of experimentally induced hypophyseal deficiency, but is equally characteristic of clinical states of hypopituitarism. The more notable of these symptoms are a tendency, in the chronic cases, toward an

<sup>1</sup> Journal of Biological Chemistry, December, 1915.

<sup>2</sup> Ibid., June, 1915.

<sup>3</sup> Journal of Experimental Medicine, July, 1915.

unusual deposition of fat, a lowering of body temperature, slowing of pulse and respiration, a fall in blood-pressure and often times a pronounced somnolence. These symptoms bear a marked resemblance to the physiological phenomena accompanying the state of hibernation which have heretofore been unsatisfactorily ascribed solely to extra-corporeal factors, namely, a seasonable deprivation of food and low temperature. In a series of hibernating animals (woodchucks), it was found that during the dormant period histological changes are apparent in many of the ductless glands. The most notable of these changes occur in the pituitary body. The gland not only diminishes in size, but the cells of the pars anterior, in some animals at least, completely lose their characteristic staining reactions to acid and basic dyes. At the end of the dormant period the gland swells, and as the cells enlarge they again acquire their differential affinity for acid, basic and neutral stains, and at the same time karyokinetic figures may appear.

On the basis of these observations, hibernation may be ascribed to a seasonal physiological wave of pluriglandular inactivity. The essential role may perhaps be ascribed to the pituitary body, not only for the reason that the most striking histological changes appear in this structure but also because deprivation of the secretion of this gland alone of the entire ductless gland series produces a group of symptoms comparable to those of hibernation.

Fry<sup>1</sup> has studied the *pituitary gland in diabetes mellitus* and disorders of the glands of internal secretion. From his work, it appears that definite histological changes occur in the anterior lobe of the pituitary in cases of diabetes in the form of adenomatous masses of eosinophilic cells, colloid invasion of the anterior lobe and areas of cellular degeneration. Histological changes in the pituitary are absent or slight in cases of acute pancreatitis and carcinoma of pancreas. Increase in weight of the pituitary occurs in myxedema due to increase of connective-tissue elements and hyperplasia of chief cells. In goitre there is hyperplasia of the chromophile cells, especially of the eosinophilic granular cells, and increase of colloid in the interglandular cleft. No histological changes were observed in the pituitary gland in a case of Addison's disease, or in a case of status thymolymphaticus. The following conception of the activity and mode of secretion of the gland is tentatively suggested: The eosinophilic and basophilic granular cells are derived from the chief cells by formation of zymogen granules. The granular cells represent a stage of active secretion, and glandular activity is greater toward the centre and posterior border of the anterior lobe. Colloid is formed from the granules. The interglandular cleft serves as an alveolus for the temporary storage of colloid. In conformity with the upward and backward direction of development of the anterior lobe, whereby it

<sup>1</sup> Quarterly Journal of Medicine, July, 1915.

becomes attached to the posterior lobe and infundibulum, the colloid secretion passes into the posterior lobe and up into the infundibulum and gains access to the cerebrospinal fluid. The hyaline and granular bodies are derived from cells of the anterior lobe which have been carried into the substance of the posterior lobe in the process of development. It is on these cells that the call for increased secretory activity first falls. Colloid in the interglandular cleft is then utilized, and, if there is an overdemand on the secretory activity of the anterior lobe, colloid may invade the posterior part of the anterior lobe, and the cells themselves become rapidly converted into colloid, until finally areas of atrophy of the cells appear. Whether the posterior lobe activates the colloid in its passage or adds some specific secretion of its own, or merely acts as an indifferent supporting structure, must be left undecided.

**Symptoms.** Csepai<sup>1</sup> discusses diseases of the *hypophysis* and the *functional diagnosis of polyglandular diseases*. He cites in detail 3 cases of acromegaly and 2 of dystrophia adiposa genitalis. In 1 of the cases of acromegaly there was an adenoma of the glandular part of the hypophysis, the histological structure of which corresponded to the normal structure of the hypophysis. Among other glands of internal secretion, marked pathological changes were found in the thyroid, thymus and ovaries. In one of the cases of dystrophia adiposa genitalis, there was an adenoma of the anterior part of the hypophysis. It showed an active tendency to spread, and its structure was completely different from that of the normal hypophysis. The direct cause of the disease was apparently the degeneration of the pars intermedia of the hypophysis. The thymus, the parathyroids and the ovaries also showed pathological changes. His research indicates that the cause of hypophyseal diabetes insipidus is hypofunctioning of the pars intermedia. This is shown by the fact that in 1 case injection of epinephrine caused a fall of 40 per cent. in the daily output of urine, and also by the fact, which has never yet been sufficiently emphasized, that diabetes insipidus is often combined with the syndrome of adiposity plus defective development of the genital organs. In addition to the progressive bone changes in acromegaly there are also marked regressive changes met with. In all of the five cases there was leukopenia, with relative mononucleosis. In one of the cases of acromegaly, there was also marked eosinophilia. In the first and second case of acromegaly, carbohydrate tolerance was very much decreased. In the other cases of acromegaly, and in the two of dystrophia adiposa-genitalis, it was normal or increased. He suggests two new methods for functional diagnosis in disease of the ductless gland system: (1) The reaction of the conjunctiva to epinephrin. Under normal conditions three drops of 1 to 1000 solutions of epinephrine cause a slight or moderate blanching of the conjunctiva that lasts for

<sup>1</sup> Deut. Arch. f. klin. Med., 1915, exvi, 5 und 6.

ten to twenty minutes. If, when the solution is instilled, the reaction is exaggerated, this indicates hypofunctioning of the epinephrin-producing system. (2) Study of the quantitative and qualitative blood changes after injection of epinephrin. Injected subcutaneously in a normal individual, epinephrin causes leukocytosis with increase of neutrophiles and decrease in the number of eosinophiles, and mononuclears. If there is any variation from this effect, it indicates disease of the ductless gland system.

After a brief discussion of the *physiology of the pituitary body* and a consideration of the *different types of dispituitarism*, Timme<sup>1</sup> concludes that the importance lies in the early recognition of pituitary disturbance. Does the patient whom you believe simply to be under par or overstrung complain of headaches? Does he readily get drowsy? Has he subnormal temperature? Does his nose bleed readily? Has he deficient perspiration even on the hottest day? Are his eyes too close together, or too far apart to be normal? Is his hairy growth peculiar in any particular? Are his teeth abnormal in character or spacing? These and similar queries, which heretofore received but scant attention from us on account of their seeming irrelevance to the condition complained of, are the vanes pointing in the direction whence comes the storm. If you wait until the patient's visual fields are destroyed, or his choked disks cry out for relief, or his acromegaly has become a real deformity, then when all the world and the text-books tell you that the disease is pituitary beyond doubt, your patient is beyond help. The early recognition of pituitary disturbance is equivalent to a reclassification of disease entities heretofore described as functional.

Haynes<sup>2</sup> reports an interesting case which first came under his observation in 1913, when the patient, a girl, was eleven years old. In 1905, at the age of three years, a diagnosis of cretinism had been made and the administration of thyroid begun. The dosage of this substance was increased from time to time because of the fact that there was no apparent improvement in the child's mental condition. During the entire year of 1912, she had 10 grains of thyroid a day. This increase brought about no improvement in the mental situation, but did result in an immediate loss of weight and a subsequent development of signs of hypopituitarism. During 1913, she was given at intervals small doses of thyroid. Early in 1914, she developed signs which drew the author's attention to the pituitary gland. The Röntgen rays revealed an enlarged sella turcica and a wrist which seemed practically normal for a girl of her age. This was surprising, considering her cretinism. There was a markedly increased tolerance for sugar, and the author, concluding that the pars intermedia was affected, administration of a preparation of this part was begun. It was interesting in following the unfolding of

<sup>1</sup> New York Medical Journal, October 16, 1915.

<sup>2</sup> American Journal Diseases of Children, November, 1915.

this case to see: (1) Symptoms which might rationally have been considered to be due to hypothyroidism clear up with the exhibition of pars intermedia. (2) The remarkable effect which the exhibition of this lobe had on the smoothness, texture, and color of the skin and its warmth. (3) The striking changes in contour of hands, ankles, hips, shoulders, thighs, etc., changes which could be made to come or recede with giving or taking away of the gland.

A somewhat similar case of pituitary disease showing both acromegaly and adiposis is reported by Williams.<sup>1</sup> When first seen, the patient, a nurse, aged thirty-two years, was in bed in a condition of extreme excitability, with a good deal of palpitation, tremor, pain in the neck and head, and boring sensation in the eyes. She had been nursing until two weeks before, and stated that previously, for ten years, she had had periodic break-downs every few months without apparent cause. The case had previously been diagnosed as one of hypothyroidism and she had been treated with thyroid gland 15 grains *per diem*. A preliminary diagnosis of hyperthyroidism from medication and arterial hypertension was made. The author was led to think that the case might be one of hypopituitarism because of the marked tenderness on pressure over the thickened subcutaneous tissues. This opinion was supported by the patient's statement that her jaw had become more prominent, and that the hands and feet had increased in size. Pituitary substance, 15 grains per day, was prescribed pending further investigation. Examination of the visual field revealed inversion of the colors and a flattening, restriction and irregularity of both fields, which led to the suspicion that there was hyperplasia near the sella turcica. The *x*-rays were applied six times in all, by the method of Béclerc. This for a while increased the excitement, so the pituitary substance was stopped. Later it was resumed and the patient has since been well, although she occasionally has a day when she is very much fatigued.

In enumerating the signs of pituitary disorder, the author found that this patient had headache, hyperplastic changes, visual disturbances, neuralgia, skeletal overgrowth of the jaw and fingers, maxillary prognathism, hypertrophy, coarse skin, dense tissue, adiposity, adiposis dolorosa, blood-pressure signs, insomnia, irritability, or wakefulness, lack of concentration and amnesia. The case is difficult of complete interpretation, but it would seem, as is sometimes the case, that with disturbance of the thyroid gland, there are alterations in the functions of the pituitary body. Sometimes the secretion of the anterior lobe is interfered with by the pressure of the hyperplasia which exists, giving rise to the tender adiposis and great asthenia. At other times the new growth seems to stimulate the action of the pituitary gland giving rise to a high blood-pressure, the excitement and perhaps the headaches

<sup>1</sup> Washington Medical Annals, March, 1915.

and general discomfort, as well as the gradual enlargement of the skeleton and its distal points, more especially the inferior maxilla. Regarded as acromegaly, the case is a very mild one, as there is no spacing of the teeth nor marked thickening of the metacarpal bones. From the standpoint of intracranial neoplasm, the condition is also mild, the only decided sign being the inversion of the visual fields.

Bramwell<sup>1</sup> reports a typical case of *pituitary infantilism of the Fröhlich type*. The patient's age was thirty-five years, height 4 feet  $1\frac{3}{4}$  inches, weight 5 stone,  $5\frac{1}{4}$  pounds. The genital organs were completely infantile, all secondary sexual characteristics were absent. The mental condition was quite normal and bright, there were no signs of a pituitary tumor. Visual fields were normal, the sella turcica very small. The epiphyses of the bones were ununited. The urine was normal, temperature normal and the blood-pressure low. In addition, he gives complete notes, with autopsy findings, on a case of gigantism with complete absence of sexual development.

He remarks that the interest of this case consists in the association of complete absence of sexual development with overgrowth of the body and the lack of any macroscopic lesion of the pituitary gland. He also cites 4 cases of polyuria occurring in connection with tumors of the pituitary body.

Kahlmeter<sup>2</sup> has met with two cases of a syndrome suggesting tabes with a negative Wassermann, and a *tumor of the hypophysis* revealed by Röntgen ray. The first case occurred in a man, aged thirty-nine years, who claimed to be of regular habits and free from venereal disease, and who has four healthy children. Always healthy until 1912, he noticed, after a trauma, that he saw double, and then the left visual field became restricted. A few months later, vision was also impaired in the right eye, and in a few months was lost entirely in this eye. Headache and difficulty in maintaining the balance and in walking soon followed. By the end of a year he had spasms of pain in his legs. There were no disturbances on the part of the stomach or bladder, but the man was impotent. The atrophy of the papilla was exactly like that of tabes, as was also the loss of knee-jerk. The röntgenogram cleared up the diagnosis by showing a tumor that had destroyed the sella turcica.

Kahlmeter's second patient was a man, aged fifty years, in whom optic atrophy and glycosuria were accompanied by such a complete change of character, or loss of character, during the last year that it seemed to indicate progressive paralysis, as also the lack of the knee-jerk, but here too the Wassermann was negative and the sella turcica was seen to be the seat of a destructive process. With acromegaly, glycosuria is not infrequent, but it is rare with other forms of hypophysis disease. Kahlmeter has found one case on record in which diabetes accompanied

<sup>1</sup> Edinburgh Medical Journal, June, 1915.

<sup>2</sup> Hygiea, Stockholm, 1915, lxxvii, No. 9.

a hypophysis tumor without acromegaly. There was bitemporal hemianopsia, and the Röntgen rays showed destruction of the sella turcica. There was also a tendency to myxedema, and the thyroid showed sclerotic atrophy to some extent. Review of the literature reveals too many instances of glycosuria with hypophysis tumor for this to be a mere casual coincidence. The various theoretical questions raised by his two cases are discussed in detail, especially Cushing's views and the results of Schweiger and others.

**Hypophyseal Polyuria.** Krikortz<sup>1</sup> describes a case of a previously healthy girl, aged six years, who developed polyuria, with general depression. After a few weeks of this, headache, stiff neck and almost total blindness came on, with other signs of cerebrospinal meningitis. The meningitis evidently was most predominant in, or restricted to, the region of the hypophysis, so that the symptoms of diabetes insipidus had been for a long time the only signs of trouble. The inflamed tissues had probably compressed the pedicle of the hypophysis and thus shut off its secretion from the blood, bringing on the diabetes insipidus. Syphilis can be excluded in this case; the meningitis was probably of tuberculous origin, although no bacilli could be discovered in the fluid drawn by lumbar puncture. The symptoms of meningitis gradually subsided; vision improved by the fifth month and the girl began to walk. The gait is still slightly spastic and there is some conjugate deviation of the eyes, but nothing pathological in the fundus of the eye.

Three cases illustrating the *relation between diabetes insipidus and the hypophysis* are reported by Motzfeldt.<sup>2</sup> The first occurred in a nurse, aged forty-two years. The diabetes insipidus developed in 1913, with diuresis of from 8 to 10 liters. She increased 20 pounds in weight, and menstruation ceased, with increasing lassitude. The intake and output of fluids, the specific gravity, the proportional elimination of chloride and nitrogen, and the total amount of the latter eliminated, were recorded day by day during three months under treatment with an extract of the posterior lobe of the pituitary body. The benefit from it was manifest; less urine was voided and the patient felt better. Treatment was then continued with pituitary substance obtained fresh from the slaughter-house each day. The beef glands were sliced and cooked, or eaten raw or dried. She thus took from two to seven each day, and finally took seven every second evening on retiring. Under this treatment she sleeps quietly all night, is not tormented by thirst, has lost two pounds and feels perfectly well, while menstruation has returned. One of the tables shows the effect of hypophysis treatment on the concentration of the urine. It was given every two hours, and the urine was examined at corresponding intervals. The density ran up at once from 1,004 to 1,014, and reached 1,017 after the fifth sub-

<sup>1</sup> Hygiea, Stockholm, 1915, lxxvii, No. 2.

<sup>2</sup> Norsk Mag. f. Laegevidenskaten, November, 1915.

cutaneous injection of 0.5 c.c. of the extract. The extract of the anterior lobe did not seem to influence the diuresis, and neither extract seemed to affect the elimination of nitrogen. In the second case occurring in a woman, aged twenty-three years, the diabetes insipidus developed after chickenpox at the age of ten years, and had persisted for thirteen years. The general aspect suggested Lorain's "hypophyseal dystrophy." The third patient was also a woman, aged thirty-nine years. Cerebrospinal symptoms of syphilis during the last four years suggest that the diabetes insipidus, present for the last six months, may owe its origin to some gummatous process in, or encroaching on, the posterior lobe of the pituitary body. The visual field was normal in all the cases, and röntgenoscopy of the base of the skull revealed nothing abnormal. Motzfeldt suggests that cases of primary polydipsia should also be examined for pituitary insufficiency.

**Association.** In 1913, Pollock reported, with postmortem findings, a case of *hypopituitarism associated with chronic hydrocephalus*. The frequency of dyspituitarism in chronic hydrocephalus may be shown by the fact that since the publication of the foregoing report, 12 additional cases have been observed by the author. He describes<sup>1</sup> 4 of these cases briefly. In all of them, adiposity was the predominating feature, ranging from that of an overnourished person to that of a monstrosity. Genital hypoplasia was observed but once; all the cases showed a delicate, pudgy, tapering hand, with broad base. Increased carbohydrate tolerance was found in all of 6 cases so studied. Not much importance can be attached to this particular feature, inasmuch as it is observed in many conditions and is not well understood. Thermic reaction, following the injection of extract of anterior lobe, was observed in none of 6 cases so tested. The similarity of serous meningitis to tumor cerebri is well known, and the inclusion of pituitary symptoms may lead to a diagnosis of tumor of the hypophysis, wrongly. The involvement of the pineal gland in the mechanical injury resulting from a cystic third ventricle deserves further study in its relation to cerebral adiposity.

Kemp<sup>2</sup> calls attention to the *relation of pituitary disturbances to paranoidal trends*. While the psychotic symptoms vary with the various glands affected, and in the same glandular disturbances in various individuals, yet in all cases the author has seen of pituitary disturbance (not a large number, he admits), the mental symptoms have invariably been paranoidal in character. If this statement be universally true, the possibility of paranoidal ideas being due to physical or chemical disturbances of the hypophysis has occurred to him. In the literature he has not as yet seen such a suggestion. State asylums yearly treat about two hundred thousand cases of insanity, and to the author it

<sup>1</sup> Journal of American Medical Association, January 30, 1915.

<sup>2</sup> Ibid., February 20, 1915.

would appear that should the superintendents of such institutions concur in their advisability, a number of experiments on the treatment of paranoidal conditions might be advantageously conducted. The proof or falsity of the idea, he suggests, could be demonstrated, and the value or worthlessness of suitable glandular therapy in this connection determined.

### DIABETES.

**Experimental Research.** Homans<sup>1</sup> has carried out an extensive study of *experimental diabetes* in the canine and *its relation to human diabetes*. He discusses the pathological relations and the etiological relations between the experimental and human forms, and, in his discussion of the clinical relations notes that the progress of experimental diabetes in the canine, though extremely rapid in comparison with the chronic course of diabetes in man, resembles it in many respects. The administration of carbohydrate food intensifies the waste of dextrose and hastens the progress of both diseases. In both, the body becomes emaciated by burning as many of its own tissues as are available. In both, there is a tendency to a fatal outcome. The life of a human diabetic, however, is lengthened if the individual is kept free, by dietary measures, from carbohydrate waste (*glycosuria*). A similar observation is suggested by the experimental observations of Homans, and has been actually demonstrated by Allen and applied by him with encouraging success in man. Homans believes, therefore, that experimental and human diabetes are, therefore, strikingly alike. The experimental disease is due to a functional deficiency on the part of the islands of Langerhans. Diabetes of man, in the author's opinion, has, in all probability, a similar immediate etiology.

In studies of experimental glycosuria, Macleod and Pearce<sup>2</sup> have noted the *level of blood-sugar* in dogs under laboratory conditions (anesthesia). Their observations were devoted, (1) to the extent of the fluctuations occurring under normal conditions; (2) to the initial height of the level in relation to the amount of glycogen in the liver; (3) to the relationship between the levels of the blood in the portal vein and vena cava. Sudden fluctuations are often due to experimental error, but this is not always the case. Momentary fluctuations exist, although usually they are very slight in degree. A progressive fall in the blood-sugar level during the first part of the period of observation was noted, this fall lasting for at least thirty minutes, and probably being due to the passing away of conditions which excite the glycogenolytic process during the anesthetization and operative manipulation of the animal. It was found that an initially high level of blood-sugar is more likely to occur in animals having a high percentage of glycogen

<sup>1</sup> Journal of Medical Research, September, 1915.

<sup>2</sup> American Journal of Physiology, October, 1915.

than in those in which there is only a trace. The secondary rise is also usually more marked in glycogen-rich animals, although it sometimes occurs in those that are glycogen-poor. A remarkable correspondence is obtained between the blood of the portal vein and of the vena cava in most cases. When any difference exists, it is always small in degree, and is, with one exception, due to a decline in the portal blood value.

In conclusion, the authors point out that although blood-sugar level in an anesthetized animal does not remain unchanged from time to time, yet the changes occurring during a period of ten minutes are small when compared with those observed in blood similarly removed from animals in which the splanchnic or hepatic nerves were stimulated.

In further studies of the *influence of glycogen on sugar storage of the liver*, Macleod and Pearce<sup>1</sup> note a quicker rise in sugar concentration in the portal blood than in that of the vena cava, and a delay after discontinuing the injection in the return to the normal level of the sugar concentration of the blood of the vena cava, and frequently also in that of the portal vein. They conclude that the existing glycogen content of the liver does not demonstrably influence the rate with which this organ removed dextrose from the blood of the portal vein.

Carlson and Ginsburg<sup>2</sup> found experimentally that the transfusion of normal blood into dogs in pancreatic diabetes causes a temporary lowering of the hyperglycemia. Before this can be taken as an evidence, however, of the presence in normal blood of an internal secretion from the pancreas, it must be shown that this temporary lowering of the hyperglycemia is due to storage and oxidation of sugar in the tissues. Their work indicates that sugar retained as a result of the blood transfusion is not subsequently excreted. If this is the case, what can happen to the sugar except oxidation in the tissues? In the first place, a temporary lowering of the rate of tissue metabolism might account for a temporary fall in blood-sugar. Or, the metabolism rate being the same, some of the sugar may disappear by way of the digestive secretions and bacterial oxidation in the digestive tract.

Sansum and Woodyatt<sup>3</sup> have studied the *effects of certain narcotic drugs on phlorhizin diabetes*. Their experiments offer no evidence that acetaldehyde is itself convertible into glucose or capable of promoting any new formation of sugar, which is in harmony with the observations of Friedmann that, in liver perfusion experiments, acetaldehyde is an acetone former, and not a sugar former. It is also concluded that the hypothesis that acetaldehyde promotes a new formation of sugar from fat has no more support than that which assigns to epinephrin a similar power. The hypotheses of antiketogenesis and diabetes

<sup>1</sup> Journal of Physiology, October, 1915.

<sup>2</sup> American Journal of Physiology, February, 1915.

<sup>3</sup> Journal of Biological Chemistry, May, 1915.

which are based on the assumption that acetaldehyde promotes a new formation of sugar from fat are wholly untenable.

**Metabolism Studies.** Janney<sup>1</sup> has found that vegetable proteins under optimal conditions are metabolized at the same rate in the animal organism. All the extra glucose and nitrogen are eliminated by the ninth hour after ingestion. Each protein produces a definite amount of glucose in the phlorhizinized organism. The various yields represent 50 to 80 per cent. by weight of the protein administered. These yields approximate the ratios which the glucogenetic amino-acids of the proteins in each case bear to the total amino-acids as actually determined by hydrolysis.

In an investigation of *glucose formation from the body proteins*, Janney and Csonka<sup>2</sup> place the average urinary G:N ratio in the fasting phlorhizin diabetic dog at 3.4:1 rather than 3.67:1 (Lusk). The body proteins of the dog collectively yield in metabolism about 57.5 per cent. of glucose corresponding to the G:N ratio, 3.6:1; body proteins of the rabbit about 60 per cent., G:N ratio, 3.8:1. Body proteins of the other higher animals, including man, very probably yield nearly the same amounts of metabolic glucose as the dog and rabbit. The calculated yield of 45 per cent. glucose as a maximum from body protein based on the ordinary G:N ratio 2.8:1 in phlorhizin pancreas diabetes is incorrect.

Janney and Blatherwick<sup>3</sup> accept 3.60:1 as representing the relation between the nitrogen contained in human muscle protein and the glucose originating from the same in metabolism. It may on these grounds be properly concluded that the proteins of the human organism collectively may yield a maximum of about 58 per cent. of glucose in diabetic metabolism. In the fasting human diabetic, the severest type, when glycogen and possible sources of glucose other than protein are exhausted, the urinary G:N ratio of 3.4:1 may therefore be accepted as an average value.

The urinary G:N quotient of man seems to be capable of clinical application, as Lusk has previously suggested. When a lowered G:N ratio prevails during a protracted fast, now the most modern treatment for diabetes, it may be reasonably inferred that the organism has not yet entirely lost its power to utilize glucose. The prognosis is, therefore, more favorable. Conversely, when the G:N ratio ranges about 3.4:1 a grave prognosis may be made, as all the glucose capable of being formed from protein is being lost to the body.

Underhill and Hogan<sup>4</sup> have studied the *influence of hydrazine on the utilization of dextrose*. They found that hydrazine causes hypoglycemia in rabbits as in dogs, but not so consistently. Starvation causes no change in the content of blood-sugar. When dextrose is administered

<sup>1</sup> Journal of Biological Chemistry, March, 1915.

<sup>2</sup> Ibid., November, 1915.

<sup>3</sup> Ibid., August, 1915.

<sup>4</sup> Ibid., March, 1915.

two days after the administration of hydrazine, its utilization, as indicated by the blood-sugar content, is markedly retarded. This is true whether the amount of sugar in the blood was previously low or not. These facts offer no explanation for the observed diminution of dextrose in the blood after the administration of hydrazine.

In further study of the *influence of hydrazine on the glycolytic activity of the liver*, the same authors<sup>1</sup> obtained results which indicated that glycolytic activity of the liver is not markedly altered by the action of hydrazine. It is, therefore, evident that their results offer no explanation for the disappearance of glycogen from the liver and the diminished blood-sugar content observed after hydrazine administration.

Underhill and Murlin<sup>2</sup> found that the subcutaneous injection of *hydrazine* into fasting dogs induced an *increased rate of carbohydrate combustion*, as measured by the respiratory quotient. This increased combustion of carbohydrate probably explains the diminished blood-sugar content, and the disappearance of glycogen from the liver and muscles observed in previous communications. Subcutaneously introduced dextrose is oxidized more rapidly in dogs that have received hydrazine than in the normal, fasting animal. Such injections of sugar to hydrazinized dogs also appear to exert a specific dynamic action. Hydrazine exerts no specific influence on heat production.

**Blood-sugar Content.** A method for the estimation of sugar in small quantities of blood has been devised by Lewis and Benedict.<sup>3</sup> The red color obtained by heating a dextrose solution with picric acid and sodium carbonate is employed as the basis of the method. The blood protein is removed by precipitation with picric acid. The method of blood-sugar determination is as follows: Two cubic centimeters of blood are aspirated through a hypodermic needle and piece of rubber tubing into an Ostwald pipet, a little powdered potassium oxalate in the tip of the pipet preventing clotting. The blood is drawn up a little above the mark, and the end of the pipet is closed by the finger. After the rubber tubing and needle are disconnected, the blood is allowed to flow back to the mark and is discharged at once into a 25 c.c. volumetric flask containing 5 c.c. of water. The contents of the flask are shaken to insure thorough mixing and the consequent hemolysis of the blood. Then 15 c.c. of saturated aqueous solution of picric acid are added, as well as a drop or two of alcohol to dispel any foam, and the contents of the flask are made up to the mark with water and then shaken. After filtration, 8 c.c. aliquots are measured out into large Jena test tubes for duplicate determinations. Two cubic centimeters of saturated picric acid solution and exactly 1 c.c. of 10 per cent. sodium carbonate are added (as well as two glass beads and two or three drops of mineral oil), and the contents of the flask are evaporated rapidly over a direct flame until

<sup>1</sup> Journal of Biological Chemistry, March, 1915.

<sup>2</sup> Ibid., October, 1915.

<sup>3</sup> Ibid., January, 1912.

precipitation occurs. About 3 c.c. of water are added, the tube is again heated to boiling to dissolve the precipitate, the contents of the tube are transferred quantitatively to a 10 c.c. volumetric flask, cooled, made up to the mark, shaken, and then filtered through cotton into the colorimeter chamber. The color is compared at once with that obtained from 0.64 mgm. of dextrose, 5 c.c. of saturated picric acid, and 1 c.c. of 10 per cent. sodium carbonate, when evaporated to precipitation over a free flame and diluted to 10 c.c. The calculation of the sugar present in the unknown blood sample is very simple. The original 2 c.c. of blood were diluted to 25 c.c., and, of this amount, 8 c.c. were taken for a determination. In other words, the aliquot contained the equivalent of  $\frac{8}{25} \times 2$  c.c., or 0.64 c.c. of blood.

The following formula may be used to find the blood-sugar content:

Mgm. of dextrose per cubic centimeter of blood =

$$\frac{\text{Reading of standard}}{\text{Reading of unknown}}$$

Other methods for the quantitative determination of sugar in the blood have been devised by Pearce,<sup>1</sup> Kahn,<sup>2</sup> and Kamimura.<sup>3</sup>

Hopkins<sup>4</sup> has used Bang's micromethod in studying the concentration of blood-sugar in health and disease. He found that in health a moderate rise in blood-sugar (0.14 to 0.15 per cent.) occurs after feeding 100 grams of glucose, reaching its height in from one-half to two hours and quickly subsiding. There is no constant blood-sugar level at which sugar appears in the urine. Evidently absorption after rectal and subcutaneous injection is slower than after feeding by mouth; however, owing to the discomfort produced by the former methods, this series is too limited to permit of definite conclusions in regard to this point. In cases in which a disturbance in carbohydrate metabolism exists, there may be a normal sugar concentration associated with a most pronounced alimentary hyperglycemia. In diabetes, alimentary hyperglycemia is pronounced, the height of the sugar level appearing at any time from one-half to three hours after the ingestion of glucose, and the duration being more prolonged than in other conditions. Pancreatic, nephritic and pituitary cases all furnish very high figures after feeding glucose, the duration lying between that of normal and of diabetic patients.

A moderate hyperglycemia occurs in many high pressure nephritic cases, and frequently in those with low phthalein elimination. In most cases of nephritis without high-pressure, the blood-sugar is normal. Edema and hepatic congestion do not influence blood-sugar values,

<sup>1</sup> Journal of Biological Chemistry, October, 1915.

<sup>2</sup> Missouri State Medical Association Journal, April, 1915.

<sup>3</sup> Mitteilungen a. d. med. Fakultat der k. Univ. Tokyo, 1915, xiii, No. 2.

<sup>4</sup> American Journal of Medical Sciences, February, 1915.

though the role they may play in alimentary hyperglycemia, which is pronounced in nephritis, Hopkins says, he is not prepared to state at this time. A rise in blood-sugar occurs in pneumonia, and may be present in the absence of fever. It is apparently uninfluenced by blood-pressure, leukocytosis, or renal involvement. Hyperglycemia occurs quite constantly in apoplexy, typhoid, tuberculoisis, in the presence of fever, and in some cases of cancer. The test, owing to its simplicity and accuracy, affords a practical method for early diagnosis and control of dietary therapeutics.

Strouse, Stein and Wisely<sup>1</sup> have found that the *Kowarsky method of determining blood-sugar* affords an efficient and accurate means of studying blood-sugar in man. The normal blood-sugar, as shown by a study of 61 determinations, varies from 0.04 to 0.12 per cent. (in one instance 0.14 per cent.) with an average of 0.084 per cent. These variations are due to the varying factors in the ordinary day of any normal individual—especially to the diet factor. Carbohydrate in the diet raises the blood-sugar. The blood-sugar of a normal man describes a curve reaching its lowest limits before breakfast and before dinner, and invariably showing a rise one hour after meals. The authors emphasize the fact that blood-sugar determinations, to be of any value, must be performed before and after ordinary meals containing carbohydrate.

In a study of the *blood-sugar content in childhood*, Bass<sup>2</sup> examined 60 children, 26 of whom were normal. The remainder suffered from a variety of complaints. The ages of the children varied from two to fourteen years. They were examined from two and one-half to three hours after breakfast, so that any postprandial hyperglycemia might be avoided. The temperature was normal in all but one case. None of the children showed glycosuria. In the series of normal children, the percentage of sugar varies from 0.072 to 0.113; in other words, it does not differ from the percentage found in adults. The age of the child does not seem to influence the sugar content, as shown by the fact that the youngest children from two to five years old had an average of 0.089 per cent.; those from six to nine years an average of 0.091 per cent.; and, finally, those from ten to fourteen years, an average of 0.087 per cent. Sex, likewise, seemed to have no influence on the ratings.

Moraczewski<sup>3</sup> observed that in persons with an inclination to glycosuria, the sugar content of the blood displayed a tendency to increase under conditions in which there was no increase in the healthy. This occurred even on a fat diet. This fact enables one to detect a latent tendency to glycemia. After a given exercise, the sugar content in the blood rises when it remains stationary in the healthy. The findings in some healthy and diabetic persons are tabulated for comparison.

<sup>1</sup> Bulletin of Johns Hopkins Hospital, June, 1915.

<sup>2</sup> American Journal of Diseases of Children, January, 1915.

<sup>3</sup> Berl. klin. Wehnschr., October 4, 1915.

After ingestion, fasting, of 200 grams sugar the healthy assimilated it completely, while the diabetic showed an increased proportion of sugar in the blood. This alimentary glycemia is due to defective utilization of the sugar, this is, to defective synthesis of glycogen, while exercise glycemia is due to absorption of sugar from its deposits, whether in muscle or elsewhere. The diabetic mobilizes his sugar reserves more promptly and completely than the healthy. Normally, in repose the sugar content of the blood declines, and it rises during and after exercise. Exercise also increases the output of uric acid in the urine; it parallels the blood-sugar content, increasing under exercise and declining during repose, regardless of the amount of urine voided. Even when sweating freely, the output of urine much reduced, the uric acid in the urine corresponded to the sugar content of the blood, both increasing during exercise, and declining in repose, in the healthy.

After vigorous exercise, ingestion of 200 grams of sugar, to test the tolerance, induces no increase in the sugar content of the urine and very little, if any, in the blood. During repose, on the other hand, it is much easier to induce glycemia and glycosuria. Hence, "exercise glycemia" cannot be compared with alimentary glycemia, as the latter leads to glycosuria, while the former augments the tolerance and counteracts glycosuria. Diabetics excrete less sugar in the urine during fever and eliminate more during repose than when exercising. Exercise glycemia is thus associated with absorption of sugar and increased power of oxidation. The above facts may have to be considered in treatment of diabetes, if confirmed by others.

**Pathological Anatomy.** Mutch<sup>1</sup> found, in 9 consecutive cases of severe diabetes mellitus, that the mean vertical length of the duodenum was  $3\frac{1}{2}$  vertebræ; the extremes being 3 and  $3\frac{1}{2}$ . Considering adults only, the average length was  $4\frac{1}{3}$  inches and the extremes  $4\frac{1}{2}$  and  $5\frac{1}{2}$  inches, respectively. These figures represent a very great enlargement of the organ; in fact, one patient's duodenum was twice as long as that of a healthy adult, and was increased in calibre also, and, upon examination after death, the walls were seen to share the same change, being thick and fleshy, and of a somewhat milky appearance. Mutch says that the same alterations in structure can be traced in the upper portions of the jejunum.

This enlargement is also invariably associated with ileal or colonic stasis, and in some patients delay is so extreme, and the consequent modification of the lower bowel so advanced, that there is no doubt in Mutch's mind but that alimentary stasis preceded the onset of diabetes; as, for example, in the case of one patient whose duodenum showed strong antiperistaltic movements. The duodenal dilatation of such patients might reasonably be ascribed to the factors which

<sup>1</sup> Practitioner, London, May, 1915.

produce this abnormality in simple intestinal stasis. In the majority of cases, however, the increase in size of the upper part of the small intestine is the predominant change in the alimentary canal, while lower bowel delay and duodenal regurgitation, although present, are not sufficiently pronounced to account for the enlargement. Fecal accumulation is evidently a common concomitant of diabetes mellitus, but not the sole determining factor, although it may be a predisposing cause. That ileal stasis plays an important part in the disease, Mutch believes is clearly shown by an analysis he made in which the patients are classified according to the severity of the acidosis. The intensity of the disease was directly proportional to the degree of ileal stasis.

Almost all diabetic patients excrete indoxyl indolacetic acid, and parahydroxyphenylacetic acid in their urine, in varying proportions. In constipated subjects, these substances arise either directly or indirectly from the action of *B. coli* on tryptophan and tyrosin in the small intestines, and the amounts excreted serve as an index of the extent to which the ileum is infected with coliform organisms. In diabetes mellitus, the excretion of these bodies does not bear any obvious relationship to the severity of the disease, from which fact it may be inferred that the gravity of the prognosis in diabetics, with marked ileal delay, depends on some condition other than the coincident infection of the small intestine with coliform organisms. A profuse growth of streptococcus *brevis* was obtained from the duodenum of a boy with severe diabetes mellitus. The suggested explanation of this phenomena is that chronic duodenitis is the determining factor in the production of diabetes mellitus, and that ileal delay increases the severity of the disease by causing stagnation in the duodenum.

**Signs and Symptoms.** Dünner<sup>1</sup> has observed a typical Argyll-Robertson pupil associated with loss of patellar reflexes and slight ataxia in a case of diabetes mellitus of nine years' standing, occurring in a woman, aged sixty-seven years. These nerve signs disappeared after a month's time but the normal reactions were still weak. The author positively excluded syphilis. In discussing his findings, he likens them to fixation of the pupil which Nonne has described as an accompaniment of chronic alcoholism. He believes the condition to be due to autotoxic changes in the nerve tissues brought about by diabetes.

**Heredity in Diabetes.** Pribram<sup>2</sup> has observed a family in which the father suffered from gout, and the mother from diabetes. The male parent of the father suffered from gout and the male parent of the mother also had diabetes. Of the nine children, nothing is known of three sons; of the other six, the three oldest children, a daughter and two sons, have diabetes. The disease made its appearance in later years, from the fortieth year on. Of ten children in the third generation of this family,

<sup>1</sup> Therapie der Gegenwart, April, 1915.

<sup>2</sup> Zentralbl. f. innere Med., 1915, No. 21.

none, so far, show diabetes. The author is watching their development with interest.

Rosenbloom<sup>1</sup> has reported a case of diabetes mellitus complicated by occasional pentosuria and lactosuria. The patient was a strong adult, male, with no apparent symptoms of diabetes mellitus. Upon examination, he proved to be a true diabetic with a tolerance of 30 to 60 grams of starch. It was also found on the ingestion of milk, that he excreted lactose in the urine, and on one occasion pentose was in the urine, but as this was found only once, the author considers it an alimentary pentosuria. The only possibilities that the author can offer as to the reason for excretion of lactose in this individual are that perhaps owing to the lack of a lactose-splitting enzyme in the intestines (possibly due to the intestinal anastomosis), the lactose as such is not stored in the liver as glycogen and, circulating in the blood as lactose, is promptly eliminated; or, owing to some pathology of the stomach, the lactose is absorbed from this viscous before hydrolysis, and is then eliminated.

**Acidosis.** During the past twelve years investigations upon the question of acidosis in diabetes have been in progress at Guy's Hospital. Beddard, Pembrey and Spriggs<sup>2</sup> state that the chief practical result of the work has been the demonstration that analyses of the CO<sub>2</sub> in the alveolar air of the lungs afford an index to the degree of acidosis and a guide in treatment and prognosis. The authors show that in cases of diabetes there is a relation between the alkalinity of the serum and the amount of CO<sub>2</sub> in the venous blood; the two rise and fall together without being actually parallel. In the non-diabetic cases, which were taken for the purpose of control, the alkalinity of the serum ranged from twenty-fifth-normal to thirtieth-normal. They also determined the tension of the gases of the blood circulating in the body. The means of fifty observations on ten men were 5.57 volumes per cent. of CO<sub>2</sub> and 14.89 of oxygen; the maxima were 6.11 and 15.59, the minima 4.87 and 13.91. Diabetic patients may have alveolar pressures of CO<sub>2</sub>, which are within the normal limits, although they are passing large quantities of sugar in the urine. When there is acidosis, the CO<sub>2</sub> falls, and in diabetic coma reaches as low a figure as 1 or 2 volumes per hundred. If under treatment with sodium bicarbonate the patient recovers, the presence of CO<sub>2</sub> may gradually rise to the normal level. Moreover, in diabetic patients, massive doses of sodium bicarbonate may raise the pressure to a height beyond the normal range.

This research has been continued by Poulton,<sup>3</sup> who, in a discussion of the results obtained, states that by means of alveolar CO<sub>2</sub> determinations, cases can readily be divided into two categories. (1) the mild cases where the alveolar CO<sub>2</sub> pressure falls within normal limits. In these cases the prognosis, with regard to coma, is relatively good;

<sup>1</sup> Journal of American Medical Association, February 6, 1915.

<sup>2</sup> British Medical Journal, September 11, 1915.

<sup>3</sup> Ibid.

(2) the severe cases in which the alveolar  $\text{CO}_2$  is definitely lower than normal; here the utmost care must be taken to prevent the onset of coma. At the time the  $\text{CO}_2$  is below normal, the patient is, as it were, on the edge of a precipice, and any disturbance, such as sudden excitement or worry, or the administration of too rigid a diet, may push him over the edge. In these cases the actual  $\text{CO}_2$  pressure observed will give the measure of the danger. A value of 2 per cent. means that coma may supervene within twenty-four hours. A value 3 per cent. or 4 per cent. is less dangerous; in the worst event coma will not come on for at least two or three days. A sudden drop in the alveolar  $\text{CO}_2$  is also of significance. It means that acidosis is increasing and though the immediate danger may not be great, there is always the possibility of a further increase until coma sets in. He compares determinations of the alveolar  $\text{CO}_2$  by means of the tensimeter devised by Fridericia with the other methods of ascertaining the degree of acidosis. The great advantage of the alveolar  $\text{CO}_2$  pressure is that it affords a measure of the actual acidosis of the blood at the time of the observation. Its sensitiveness as an indicator depends upon the sensitiveness of the respiratory centers to changes in the hydrogen-ion concentration of the arterial blood. This sensitiveness is very high. Apart from theoretical advantages, alveolar  $\text{CO}_2$  determinations by the tensimeter method present many practical advantages. The apparatus is easy to use; it can be readily carried about from case to case; the method requires but little practice; the results are of a high degree of accuracy, and they are of the greatest significance in the treatment and prognosis of diabetes. In fact, to anyone who has once used the method, it would appear absolutely impossible to treat satisfactorily a severe case of diabetes without it.

Rosenbloom<sup>1</sup> has studied the *acetone bodies* in 5 cases of *diabetes*. All 5 cases showed a marked increase in the amounts of the acetone bodies excreted in the urine when the protein intake was increased; and when the protein intake was lowered, the amount of the acetone bodies excreted was lessened. These results may also explain partially the remarkable effects of the so-called green days and oatmeal days in lessening the amount of acetone bodies excreted in the urine. As both of these diets contain very little protein (typical green days 30 grams, and typical oatmeal days 51 grams), it may be that part of the lessened excretion of acetone bodies is due to the lowering of the protein intake.

It is most likely that the increased excretion of the acetone bodies produced by increasing the protein intake is due to the fact that some of the amino-acids present in the protein act as ketogenic substances.

It is well known that of the constituents of ox meat, the leucin, tyrosin and phenylalanin are ketogenic, and it may be that the increased

<sup>1</sup> Journal of American Medical Association, November 13, 1915.

excretion of the acetone bodies is due to the presence of these amino-acids in the increased amount of meat protein ingested.

Another reason to suspect that this is the case may be found in the results obtained by Moorhouse, Patterson and Stephanson. Of the various proteins studied they found that in regard to their effect on the excretion of acetone in dogs rendered diabetic, gelatine produced a marked diminution in the excretion of these bodies. He thinks the explanation of this result is due to the fact that gelatine contains very small amounts of leucin, tyrosin and phenylalanin.

The importance of restricting the amount of protein in the diet of diabetes has long been well known in regard to the sugar excretion. In this paper, data are presented showing the importance of restricting the protein intake in diabetes in relation to lessening the amount of excretion of the acetone bodies in the urine. It is possible that, by selecting proteins free from those amino-acids that are ketogenic, we may be better able to control the formation of the acetone bodies in this disease.

Rosenbloom<sup>1</sup> has studied three cases of diabetic coma which differed completely from our modern idea of acidosis as the cause of coma. They were all of the severe type, with no tolerance for carbohydrate, and with a restriction of protein intake there was no lessening of the glucose output. They were studied for a period which varied from one week to two months. During this time the urine contained a normal amount of ammonia-nitrogen and showed no trace of acetone, diacetic acid or beta-oxybutyric acid. There was no evidence of any kidney disease. The urine contained excessive amounts of colloidal nitrogen, neutral sulphur and amino-acids. Death occurred in typical diabetic coma. In the last case studied, 200 c.c. of blood were taken shortly before death. Only faint traces of acetone, diacetic acid and beta-oxybutyric acid were found. The non-protein nitrogen of the blood serum was normal in amount. This case is especially interesting on account of the fact that about fifty hours before death, showers of granular casts were present in the urine. The urine was cloudy, owing to the presence of such an enormous number of casts. An intravenous injection of 600 c.c. of 6 per cent. sodium bicarbonate produced a marked improvement in the symptoms.

Rosenbloom believes that his observations show the necessity for changing our views relative to the exciting factors present in all cases of diabetic coma. The inadequacy of the alkaline therapy, he says, can be explained on the basis that the acetone bodies are not the important factors in the causation of the symptoms in all cases of diabetic coma, but that more attention must be paid to the study of the excretion of the amino-acids, polypeptides, and certain unknown substances, in this disease.

<sup>1</sup> New York Medical Journal, August 7, 1915.

**Treatment.** Cammidge<sup>1</sup> calls attention to the importance of the *nitrogen balance* in the treatment of diabetes. The occurrence of defects in the utilization of proteins, and the results of increasing protein content of the diet beyond the patient's power of dealing with them efficiently, are unfortunately not so well known as the defects in carbohydrate metabolism, although they are equally important. In a healthy individual, the total urinary nitrogen is practically equal to the amount ingested, barring the small extrarenal excretion in the feces, perspiration, hair and nails, which averages about 1 gram daily. The level of nitrogenous equilibrium varies with the character of the diet, although there is always a tendency to establish a correspondence between the intake and the output, in spite of weight variations in the nature of the food. A similar tendency is seen in diabetics, but their powers of adaptation are diminished, and in advanced cases may be very defective. The prognosis in cases in which the output of nitrogen in the urine regularly exceeds the intake in the food is always serious, for unless nitrogenous equilibrium can be established, loss of weight and strength must continue while the tendency will be for the glycosuria and acidosis to increase. Systematic reduction of the protein intake guided by daily analyses of the urine suffices to control the condition, but rest in bed, with freedom from excitement and worry, is sometimes also necessary. The free use of opiates may be required occasionally. Abnormalities of the nitrogen balance are not confined to advanced and serious cases, but may exist when the urine contains only a small amount of sugar, and when the glycosuria has been controlled by an antidiabetic diet. Loss of strength, irritability of temper, nervous disturbance, neuralgic pains and complaints of difficulty in keeping warm are the commonest suggestive symptoms. Diminution in weight is a more certain indication, but is apt to be a fallacious guide unless found to be progressive in character.

The *Allen method of treatment* described in these pages last June has met with most enthusiastic endorsement in the writings of the year. Christian<sup>2</sup> finds that the starvation method of Allen for rendering a diabetic sugar-free, in addition to being a safe method, has shortened very materially the time required to get a diabetic patient sugar-free, and so permits of a large part of the patient's stay in the hospital being devoted to building up the tolerance for carbohydrates. To put it another way, the method saves for the patient and for the hospital, one or two weeks of time.

Joslin<sup>3</sup> has also found the Allen method admirable. The more closely Allen's directions were followed, the better the patients got along. No patient has required more than five days to become sugar-free. Many

<sup>1</sup> Lancet, London, November 27, 1915.

<sup>2</sup> Boston Medical and Surgical Journal, June 24, 1915.

<sup>3</sup> American Journal of Medical Sciences, October, 1915.

patients became sugar-free after the omission of three or four meals. Patients are put to bed, and the plan of the treatment is carefully explained to them. They are furnished with note-books in which answers to their questions are recorded, taught the use of a diet card, and how to examine the urine for sugar with Benedict's solution. So far, no patient whom Joslin has taught to test his own urine during the last year has died. He is coming to feel that coma no longer represents the culmination of the disease, but that it is an avoidable accident.

Eight patients were treated by Hill and Sherrick<sup>1</sup> according to the Allen starvation plan. In every case the patient has become sugar-free, and has stayed so, on a reasonable diet which enabled him to hold his weight. Some of these were severe cases of diabetes, young people treated before by the old method and who could not be made sugar-free. When the patient was discharged from the ward, he was given written diet slips with two or three menus which he could use on different days, figured out carefully to correspond with his tolerance. The two most important things to remember in this treatment are the following: (1) do not raise the diet too quickly after starvation, and pay just as much attention to the protein intake as to the carbohydrate; (2) do not worry if the patient loses weight; it will not hurt him.

There has been no sign of coma in the 8 cases treated. The ammonia has always been low, only in 1 case reading as high as 2.5 grams per day, which is not at all a high ammonia output. In most of the cases it has been very low, usually under 1 gram a day. This very possibly is due to the low protein intake. There was nothing constant in the appearance or disappearance of the acetone and diacetic acid while on starvation. In one case both disappeared; in others, they increased slightly, and in others stayed practically the same. No patient has lost more than five pounds during his treatment and no patient has gained more than seven pounds. In most of the cases the weight at discharge was practically the same as at entrance.

Bookman,<sup>2</sup> during the past year, treated 24 severe cases of diabetes mellitus according to the Allen method. He states that the treatment may be used in all cases. In older persons who are passing small amounts of sugar, with little or no acidosis, less drastic measures will usually be preferred. In such patients the glycosuria will frequently disappear if sugar is abstained from, or if, in addition, the starches are moderately restricted. In all other cases the treatment is advisable. It is especially indicated in all youthful diabetics, in all patients who are passing large amounts of acetone bodies, and in all those who for any reason it is especially desired to make aglycosuric as quickly as possible. His results agree with those obtained by Allen and others who have worked with this method. The patients have rapidly become sugar-free, and,

<sup>1</sup> Boston and Medical Journal, May 13, 1915.

<sup>2</sup> New York Medical Journal, December 18, 1915.

with few exceptions, have improved in every way. The results in the juvenile cases are most convincing. In the management of severe diabetes the method is a great step in advance. As a routine measure in all diabetes, it brings excellent results and brings them quickly.

Heyn and Hawley<sup>1</sup> also report favorably on the use of this treatment.

The writer, in conjunction with Jonas and Austin,<sup>2</sup> has recently had the opportunity of treating and studying a number of cases of diabetes and of applying the Allen treatment. We feel that while Allen's treatment is desirable in only a small proportion of diabetics, it affords a means of shortening the first stages of the treatment of those diabetics that do not promptly become sugar-free when placed on a carbohydrate-free diet, and that it is the most effective treatment for the severe cases exhibiting high ketonuria; cases that with other methods of treatment probably either would fail to become sugar-free at all, or would pass in a short time into coma.

Allen<sup>3</sup> has made an addition to the treatment of severe diabetes in the form of exercise. Authorities on diabetes have agreed that muscular exercise is a useful means of increasing tolerance in cases of mild or moderate diabetes, but its action is unfavorable in the severe cases. Since the change in diabetic treatment now transforms severe into mild cases, as far as freedom from glucose and acidosis is concerned, it has been considered worth while to investigate whether such patients might also react to exercise in the same way as mild cases. Tests were made first of diabetic dogs with a known constant limit to tolerance of carbohydrate or protein. It was found that vigorous exercise on the tread-mill markedly raised the tolerance of such animals as judged by the sugar in both urine and blood. In some experiments dogs which for months past had regularly shown glycosuria when they were given 100 grams of bread, on exercise became able to take 200 grams of bread as a regular daily ration without glycosuria. The tests with patients are more recent, but the results thus far appear sufficiently favorable to warrant recommending exercise as an addition to the treatment. Just how early the exercise is begun may vary with individual patients. It seems possible that the stronger patients may shorten their initial fast by this means, if desired. As soon as the first few days of treatment have markedly reduced glycosuria and ketonuria, the dangers previously feared from overexercise are apparently removed. Naturally, some of the severest cases are too weak for exercise at first, but it is begun as early in the period of dieting as practicable, and generally the weak patient is able to do more than he or his physician supposed. In suitable cases, the blood-sugar may be found to fall rapidly during one-half hour or one hour of lively exercise. In the earlier or more severe cases

<sup>1</sup> Lancet Clinic, Cincinnati, July 10, 1915.

<sup>2</sup> Pennsylvania State Medical Journal, January, 1916.

<sup>3</sup> Boston Medical and Surgical Journal, November 11, 1915.

it may rise thereafter, but often it will continue to fall after the exercise has ended and remain for some time at a lower level. In a patient free from glycosuria with persistent hyperglycemia, one fast day with exercise may reduce the blood-sugar as much as several fast days without exercise. If glycosuria is produced in a patient by adding either carbohydrate, protein or fat to the diet, it is frequently possible to abolish this glycosuria by exercise while continuing the increased diet. It seems dangerous to give exercise especially after a meal containing carbohydrate or other food tending to produce glycosuria, although when patients are able to they exercise at all times of the day. Short periods of vigorous exercise, with rests, are preferable to long slow walks which may be tiring. The exercises now suggested are running up and down stairs, jumping rope, throwing a heavy medicine ball, and turning somersaults. Tennis and other hard games should probably be beneficial. At first, precautions may be taken against nervousness and sleeplessness sometimes caused by overweariness in weak patients; otherwise, patients are worked right up to the limit of their strength, somewhat like athletes in training.

Davidoff<sup>1</sup> has found that *honey* is a beneficial *substitute for sugar* in diabetes. The sugar in the urine decreases under its use, and it has been observed after having left off its administration for a while, that an increase in the sugar-content takes place. On its readministration, the sugar-content again falls. He reports 7 cases in which the administration of honey was beneficial.

Williamson<sup>2</sup> advocates casein and cream as a diet in diabetes. This contains the milk albumen and fat, but only a small proportion of milk sugar. The patient is kept at rest and every two hours, from 8 A.M. to 10 P.M., receives a glass of artificial milk prepared from casein, cream and water. Though he has never had any serious bad results, it was necessary to discontinue the treatment in a small percentage of cases owing to the onset of untoward symptoms, principally those of exhaustion and depression. In a few cases it produces dyspepsia, diarrhea or constipation, but in the majority of cases it can be followed quite easily without unfavorable symptoms.

## GOUT.

The writings of the year have been confined almost entirely to studies of the uric acid and its relation to the disease.

**Uric Acid.** Fine and Chace<sup>3</sup> have studied the *influence of salicylates on the uric acid concentration of the blood*. Their investigations embraced 1 case of gout, 1 of rheumatism, 1 of asthma, 4 of arthritis and 1 of hysteria. They found that the administration of salicylates brought

<sup>1</sup> Russky Vrach, 1915, xiv, No. 26.    <sup>2</sup> British Medical Journal, March 13, 1915.

<sup>3</sup> Journal of Biological Chemistry, June, 1915.

about a reduction of the uric acid in the blood, in some cases in a most pronounced manner, twice causing an almost complete disappearance of this element. They have made a few observations upon the influence of certain other drugs on the uric acid concentration of the blood. In 2 cases treated with 5.3 grams of theobromin sodium salicylate daily (one for eleven days and the other for two days), there was, if anything, a slight increase in the concentration of blood uric acid. The same may be said with regard to quinine hydrochloride (2 grams per day for two days in one case), and for colchicum (maximum dose in two cases).

The increased output of uric acid following the administration of salicylates, Denis<sup>1</sup> holds is due to a lowered threshold value of the kidney, not only for uric acid, but in all probability for other waste products as well. Such being the case, he says, it may well be that the beneficial effects resulting from the use of salicylates in acute rheumatic fever, may, in part at least, be due to a power possessed by this class of drugs of increasing kidney permeability, thereby facilitating the rapid and more or less complete excretion of the toxins which produce symptoms of these diseases.

Denis<sup>2</sup> has also investigated the *effect of ingested purins on the blood uric acid*. His results show the effect of purin-free and of high purin diets on the uric acid content of the blood of normal men and of persons suffering from various chronic diseases. In normal men no increase in the circulating uric acid is produced by the ingestion of large quantities of purin. In persons suffering from renal insufficiency, a more or less marked increase in the uric acid content of the blood is produced by high purin feeding. It is, therefore, concluded that when the determination of uric acid in the blood is undertaken as a diagnostic test, the insistence on a preliminary period during which no purin-containing foods are consumed is unnecessary, except in cases in which kidney insufficiency exists, or perhaps in the case of persons who habitually consume extremely large quantities of purin-containing foods.

Benedict,<sup>3</sup> in his studies of uric acid metabolism, has noted the uric acid content in the blood of the ox and the chicken. He isolated 6.7 mgm. of uric acid from 100 c.c. of ox blood and identified this by its crystalline appearance, solubility, murexide test, colormetric value and nitrogen content. The regular colormetric determination gave a value of 7.0 mgm. "total" uric acid per hundred cubic centimeters for the blood of the ox; thus showing the accuracy of the colormetric process and of the procedure used for the isolation of the uric acid. He found that the uric acid is quantitatively contained in the corpuscles. Twenty-five cubic centimeters of clear serum gave not the slightest color reaction for uric acid. The corpuscles, on the contrary, yielded figures for uric acid.

<sup>1</sup> Journal of Pharmacology and Experimental Therapeutics, October, 1915.

<sup>2</sup> Journal of Biological Chemistry, November, 1915.

<sup>3</sup> Ibid., April, 1915.

closely approximating those obtained for the volume of the whole blood from which they were derived.

Sharply contrasting with the findings for the uric acid contained in ox blood stand the results obtained from chicken blood. Four and eight-tenths per hundred grams of blood constitute the uric acid content of chicken blood. Furthermore, while the serum of ox blood is free from uric acid, the uric acid in chicken blood is almost entirely contained in the serum, the concentration in the serum being very appreciably greater than in the whole blood, 5.7 mgm. per hundred cubic centimeters of serum. The question as to which form of corpuscle contains the uric acid in ox blood is of obvious importance and will be reported upon shortly.

Investigations of the *endogenous uric acid metabolism* have been carried out by Raiziss, Dubin and Ringer.<sup>1</sup> They studied the uric acid elimination of ten individuals. It was found that on a vegetable (meat-free) diet the uric acid output was considerably lower than was previously reported in the literature. It was also found that different individuals, under the same conditions of diet and rest, eliminate practically the same amount of uric acid per day. Work and high protein intake cause an increase in uric acid elimination. In changing from a mixed to a vegetable and meat-free diet, at least a week must be allowed before the uric acid output will reach a constant level. The output during the first few days is higher, in all probability, because of an elimination of accumulated purin in the tissues of the body.

On placing two individuals on a practically nitrogen-free diet, which was at the same time strictly nuclein-free, after a vegetable diet period, the uric acid elimination dropped to about half of what it was on the vegetable diet (0.040 gram per day). On giving milk, eggs and zwieback to the extent of 12 grams of nitrogen per day to one of these, immediately following the nitrogen-free diet, the uric acid output rose but very slightly (maximum of 0.058 gram. per day). But when the vegetable diet was resumed, the uric acid nitrogen elimination rose again to its former level of 0.104 gram per day. These findings suggest the possibility that the true endogenous uric acid output is really much smaller than has been found heretofore, and that in order to obtain it, the subject must be kept for a long time on a strictly purin-free diet and in a condition of absolute rest.

Liefmann<sup>2</sup> has made numerous determinations of the *uric acid in the blood of children* under various conditions of health and disease. He found the uric acid content of normal children on a purin-free diet to lie between 1.3 and 1.7 mg. per hundred cubic centimeters of blood. This content rose gradually during the course of childhood and reached the value of 2 to 4 mg. in the adult. On a diet containing purins, the uric acid

<sup>1</sup> Journal of Biological Chemistry, December, 1915.

<sup>2</sup> Zeitsch. f. Kinderheilkunde, 1915, vol. xxii, Nos. 4 and 5.

content quickly rose, and then gradually fell to normal. Severe general disturbances of the organism were accompanied by an increase in the uric acid content of the blood. After the administration of atophan there was a decrease in the blood uric acid, while following the administration of "protojoduret," there was an increase. Certain infectious diseases, like dermatitis exfoliativa, are accompanied by an increase of the blood uric acid. This increase was not noted in intertrigo, erythrodermia or eczema. Chronic bronchitis without fever, associated with those phenomena which Czerny considers the symptoms of the exudative diathesis, showed an increase in the blood uric acid. The author believes that his researches do not support the consideration that an increase of the blood uric acid is an obligate symptom of the exudative diathesis nor does it support the view that there is a relationship or dependence between the exudative diathesis and the urate diathesis.

Daniels and McCrudden<sup>1</sup> have studied the *relation of uric acid to gouty attacks*. The data obtained from their investigation of 2 cases of gout showed that there was no more uric acid in the blood than in blood of normal individuals. The amount of uric acid in the blood was not altered during acute attacks of gout. Uric acid excretion was not altered during acute attacks of gout. Attacks of gout appeared during atophan administration, when, as shown by chemical analysis, the uric acid content of the blood had been greatly decreased.

Through prompt analyses of tissues and fluids obtained postmortem and at the operating table, Fine<sup>2</sup> has found that, contrary to Schittenhelm and Wiener, uric acid can be demonstrated in considerable concentrations in human tissues.

Folin and Denis<sup>3</sup> discuss the *diagnostic value of uric acid determinations in the blood*: In making use of blood analysis to decide whether a given doubtful case of joint disease is gout or arthritis, the authors state that it is absolutely necessary to determine the non-protein nitrogen (or at least the urea) in the blood, as well as the uric acid. And, before the blood is drawn for such analyses, it is indispensable that the patient should have been on a purin-free diet for at least two days. The level of the protein metabolism should also be ascertained by means of a nitrogen determination in the twenty-four-hour urine passed during the last day of the experiment. In gout, the blood is almost invariably abnormally high in uric acid, while the other waste products represented in the non-protein nitrogen of the blood are usually within the normal limits. In arthritis, also, the blood is not infrequently abnormally high in uric acid, but most of such cases have abnormally high non-protein nitrogen as well. Neither qualitative tests for uric acid in the blood nor quantitative determinations of the uric acid alone can be depended on in the differential diagnosis of gout and other joint diseases.

<sup>1</sup> Archives of Internal Medicine, June, 1915.

<sup>2</sup> Journal of Biological Chemistry, December, 1915.

<sup>3</sup> Archives of Internal Medicine, July, 1915.

*Colorimetric methods for determining the blood uric acid* have been devised by Benedict,<sup>1</sup> Masse and Zondek<sup>2</sup> and Host<sup>3</sup> and a colorimetric method for the estimation of the uric acid in the urine is described by Benedict and Hitchcock.<sup>4</sup>

Fine and Chace<sup>5</sup> have studied 6 cases of nephritis with the object of learning the *power of the nephritic kidney to eliminate uric acid after the use of atophan*. The first case showed a very slight response to atophan before the onset of marked uremic symptoms. The second case was one of advanced nephritis which showed no reaction to atophan. The third case was clinically in good condition and showed a moderate response to the drug. The fourth case showed no response whatever, which was in harmony with the pronounced retention of creatinin and the negligible output of phenolsulphonephthalein. The clinical prognosis in this case was early fatal termination. In case five there was a definite response to the extent of reduction of blood uric acid to 2.4 mg. per hundred cubic centimeters. This favorable response falls in with the moderate retention of urea nitrogen and creatinin and the quite good output of phenolsulphonephthalein. Clinically, the case at present appears not to be in a serious condition. In case six, the response to atophan was quite decided, which is of interest in connection with the fair elimination of phenolsulphonephthalein and the but slightly increased urea and creatinin concentrations of the blood. It is evident that in these six cases there is a general relationship between the degree of response to the administration of atophan on the one hand, and the extent of non-protein nitrogenous retention and the clinical pictures on the other. While the authors hesitate, on the basis of these few cases, to formulate definite conclusions, the observations seem to lend some support to the view that abnormal renal cells would be expected to prove less responsive to the action of atophan than normal healthy cells.

**Diagnosis.** Burkhardt<sup>6</sup> describes a cystoid degeneration beginning in the epiphyses of the metatarsals, and occasionally also in the phalanges extending to the articular cartilage and giving rise to a perforative synovitis which may be readily mistaken for gout. It can be distinguished from gout by the absence of swelling of the regional lymphatic glands. It may, however, become gouty from a concomitant disease of the kidney, with a retention and accumulation of uric acid in the blood. This change to a gouty nature is accompanied by the diagnostic element of gout, namely, the enlargement of the regional lymphatic glands which have also become hyaline.

<sup>1</sup> Journal of Biological Chemistry, April, 1915.

<sup>2</sup> Muench. med. Wehnsehr., August 17, 1915.

<sup>3</sup> Norsk. Mag. f. Laegevidenskaben, September, 1915.

<sup>4</sup> Journal of Biological Chemistry, April, 1915.

<sup>5</sup> Archives of Internal Medicine, September, 1915.

<sup>6</sup> British Medical Journal, July 31, 1915.

**SCURVY.**

Very little has been written on scurvy during the past year. Ingier<sup>1</sup> has been able to produce marked cases of Barlow's disease in the fetus as early as ten to fifteen days after the commencement of dieting pregnant guinea-pigs with oats and water. There are wide individual variations. The scorbutic changes in the skeleton are greatest in the earlier embryonic stages. The fetuses of that period, with practically no exceptions, die, and show marked traces of impeded growth. Fetuses from the later period of pregnancy are born alive and apparently fully developed, with comparatively slight changes in the osseous system. Even a short extension of the period of extra-uterine dieting on milk from scorbutic mothers, and later on oats and water, is sufficient to change the latent scurvy into a highly pronounced case. The fetus cannot be kept alive longer than the adult animal, about twenty-eight days, either by intra-uterine dieting alone or by combined intra-uterine and extra-uterine dieting. The mothers show signs of disease at an early period, and are more severely attacked than non-pregnant animals. Death also occurs comparatively often in the first period of gestation.

Hess<sup>2</sup> has found, in several instances of infantile scurvy, definite cardiac enlargement, ascertained by means of physical signs and Röntgen examination. Necropsies also show that the heart in some cases is hypertrophied and dilated. The examinations made during life, as well as those carried out after death, demonstrated that this enlargement was mainly of the right ventricle. Another symptom, which should be accorded greater significance, is edema, which is almost always present to some degree. This occurs early in the course of the disease and involves most frequently the eyelids. It is often manifested as a firm edema over the lower end of the tibia, infiltrating the skin, and is readily overlooked, as it does not pit on pressure. This extravasation, which is due to nutritional disturbance of the smaller vessels, may also infiltrate the muscles. When this occurs in the thigh and causes swelling, it may be mistaken for the typical subperiosteal hemorrhage.

It would also seem probable that the nerves are involved in infantile scurvy. The knee-jerks are increased, and there are indications of superficial tenderness of the limbs and neuro-edema of the optic disks.

In the light of this symptomatology and pathology, infantile scurvy assumes actual relationship to beriberi, in which the right heart is also hypertrophied and the nerves invariably involved. This correlation was emphasized still further by a dietetic test modeled after the treatment of beriberi, which, as is well known, is brought about by a diet of polished rice which has been deprived of its pericarp, and is cured by the addition

<sup>1</sup> Journal of Experimental Medicine, June, 1915.

<sup>2</sup> Journal of American Medical Association, September 18, 1915.

of rice polishings to the diet. In their study, the addition of middlings—the pericarp of the wheat—caused in many instances a prompt amelioration of the symptoms, although it did not suffice to cure the disorder. This indicates the advantage of giving a cereal which contains the outer layers of the grain when the diet includes no other antiscorbutic food.

In a paper on new features in the diagnosis of scurvy, Brown<sup>1</sup> remarks that the absence of periosteal hemorrhage, as shown by Röntgen examination, does not exclude scurvy as it has been shown recently that extravasated blood is very radiable and only when the disease is well advanced and some organization of the clot has occurred does it exhibit itself on the *x-ray* plate. The first definite evidence of scurvy is the appearance of the "white line" which precedes the occurrence of the hemorrhages. A high temperature, with a polymorphonucleosis, is not incompatible with a scorbutic condition, but occurs, on the other hand, only in the severe and most advanced cases. Here a faulty diagnosis of pus is apt to be made and the presence of the "white line" is a valuable aid to diagnosis. The association between scurvy, rickets, tetany and beriberi is very intimate. The production of these various ailments occurs through the improper handling of our food stuffs altering the constituents in such a way as to completely upset the proper balance of mineral salts within the organism. Why rickets is produced in one case, tetany in another, and scurvy in another, it is impossible to state. In rickets, the loss of calcium is definite, while the evidence at hand shows that in tetany, sodium and potassium act as the irritating salts, and calcium and magnesium as the sedatives. In scurvy, the calcium retention is unexplained. It yet remains to be proven whether the vitamines are, as it were, the controller of the mineral metabolism of the body. The role of the thyroid and parathyroid is purely that of assisting in the general metabolic processes.

<sup>1</sup> Archives of Pediatrics, October, 1915.

## OPHTHALMOLOGY.

By EDWARD JACKSON, M.D.

**Ophthalmoscopy of the Angle of the Anterior Chamber.** Attention was called last year<sup>1</sup> to the observations made by Salzmann on the peripheral portion of the anterior chamber, which is hidden from ordinary inspection. No other observer has reported results with this method of examination. But trial of the method confirms some of Salzmann's observations; and Salzmann now reports additional observations made upon 39 cases. These are illustrated by 29 colored plates. In the normal eye the scleral wall of the angle of the anterior chamber may appear a uniform grayish white, lighter or darker in different cases. But frequently it presents a streak, which Salzmann takes to be caused by Schlemm's canal. This streak was usually gray; but in four or five eyes it was distinctly pink. This is believed to indicate that Schlemm's canal is commonly filled with a transparent fluid, but in some cases contains diluted blood. The visibility of the streak may depend on the transparency of tissue lying between it and the angle of the anterior chamber.

The observations previously made on the edge of the ciliary body and the root of the iris are confirmed. In normal eyes, the bulging of the iris surfaces hides its extreme periphery. In pathologic eyes, various pigment deposits were visible, loops of vessels have been observed in this region and remains of hemorrhages. One of the plates shows the discoloration of the tissues characteristic of siderosis; the whitish reflex of the sclera being replaced by a dark, reddish-brown coloring. Various iris projections, and peripheral anterior synechiæ, are illustrated. A more general acquaintance with this method of diagnosis may show that it has especial value in diseases of the uveal tract and glaucoma.

**Conduction Anesthesia.** Seidel<sup>2</sup> has produced anesthesia of the eyeball and surrounding parts by nerve block, through solutions injected into the apex of the orbit, through the sphenomaxillary fissure, entering between the ramus of the jaw and the superior maxilla. After disinfection with tincture of iodin and superficial anesthesia by infiltration, a needle 4 cm. long is entered a finger's breadth beneath the prominence of the malar bone and directed toward the apex of the orbit. About 6 c.c. of a 1 per cent. solution of novocain with adrenalin is injected along the posterior surface of the maxilla and into the pterygopalatine fossa.

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1915, p. 413.

<sup>2</sup> Graefe's Archiv f. Ophthalmologie, 1915, vol. lxxxix, p. 414.

Five minutes later, a needle 8 cm. long, and almost 1 mm. thick, containing a stylet as for lumbar puncture, is carried slowly along the anterior edge of the masseter muscle. The point toward which the needle is directed is located in this way: With the mouth closed, and the head raised so that the lower edge of the jaw is horizontal, a tape measure is carried back of the ears vertically from one mastoid to the other. A point one thumb's breadth from the median line, on the side opposite the orbit to be anesthetized (that is, on the coronal suture, a thumb's breadth from the median line) is the point aimed at.

When the needle has penetrated about 4.5 cm. in this direction, somewhat stronger resistance indicates the fibrous closure of the infra-orbital fissure is being encountered, and slight pain is caused. The needle has now entered the orbit. The stylet is withdrawn, a syringe attached, and 1 c.c. of novocainadrenalin solution injected. Slight exophthalmos produced by this injection proves the fluid has entered the orbit. The needle is pushed forward 5 to 10 mm. and another cubic centimeter is injected. Pushing the needle 2 cm. farther, firm resistance indicates that it has reached the upper wall of the orbit. The needle is then slowly withdrawn, and, during the withdrawal, 4 c.c. more of the solution is injected.

Seidel has used a 2 per cent. solution of novocain with not more than six drops of adrenalin solution. But he thinks that a 4 per cent. novocain solution is better, requiring the injection of a smaller amount into the orbit. After injecting the anesthetic, twenty minutes should elapse before the operation is begun. This method has been employed for panophthalmitis, carcinoma of the orbit, and other conditions involving severe inflammation, or extending to parts adjoining the orbit.

#### THE CONJUNCTIVA AND CORNEA.

**Ophthalmia Neonatorum.** The strong contrast between the benign tendency of this disease and the malignancy of gonorrhreal conjunctivitis in the adult has received attention from Derby,<sup>1</sup> who subjected the blood from twenty-three infants suffering from this disease to the complement-fixation test. The reaction was found strongly positive in two, and weakly positive in three. But, in spite of the large proportion of negative results, Derby believes that the mildness of the disease in infants is best explained by a certain degree of immunity transferred by the gonorrhreal mother to her offspring. This immunity probably lasts only a few months.

Among 149 cases, Derby found the gonococcus in 77. This is a somewhat lower percentage than has been found by most other observers. But it is probable that more than one-third of all cases classified as

<sup>1</sup> Transactions of the Section on Ophthalmology of the American Medical Association, 1915, p. 136.

ophthalmia neonatorum are due to causes other than the gonococcus. A striking fact observed in Derby's cases was that in 56 of them no organisms whatever were found in the smears. This he explains by the fact that the patients were first seen at a comparatively late date, the average age on admission being over twelve days. This may also explain the difficulty in obtaining cultures of the gonococcus, even on media which were proved favorable for gonococci obtained from the urethra or the joints.

Derby's cases were treated in special wards of the Massachusetts Charitable Eye and Ear Infirmary; and he believes that the vast majority of severe cases should be treated in hospitals. It is an extremely contagious disease, dangerous to sight. The treatment requires frequent handling of the infant. This is detrimental to any normal infant, but less so at the hands of a skilled nurse than it would be in the average home. When possible, the mother should be admitted to the hospital, or can come twice a day to nurse the baby. When this is not possible, the breast milk may be obtained and brought to the hospital and used.

Seventeen of these children were premature, and 16 weighed under five pounds. The death-rate for the first year of life among these infants was 0.8 per cent., which compared favorably with that in the community at large. Only six infants died in the hospital. Of these, two were premature, one died of meningitis, one of pneumonia, and two of hemorrhagic disease. In spite of his favorable experience, Derby points out the dangers of treating such cases in a general hospital not especially prepared to take care of them—dangers that have caused other writers to lay down the rule that they should not be brought to a hospital if they could be treated at home.

Of Derby's 77 gonococcus cases, 18 remained monocular; and in 44 the disease developed in both eyes on the same day. In no case did the second eye become infected after the patient was brought into the hospital. The precautions that seemed to be effective were: To keep the child lying on the infected side with its hands and arms confined. A drop or two of protargol or argyrol may be put into the healthy eye two or three times a day; but Derby thinks this less important than general cleanliness.

In this series of cases the cornea was involved in 24. In 16 of these the gonococcus was found, and in the others it had probably been present earlier. In 8 cases the sight was permanently damaged, both eyes being affected in 5. In no case did the cornea become involved after the child was brought into the hospital. All the cases of damaged cornea were carefully investigated, and, as a result, one physician was prosecuted and found guilty, and one midwife was forced out of practice.

In the treatment of ophthalmia neonatorum, Derby prefers, in general, a non-irritating drug. He thinks bactericidal power is of little

importance, as the gonococci lie too deep to be reached by remedies at our disposal. He prefers argyrol in 25 per cent. solution on account of its high specific gravity, causing it to float up the discharge from the deeper folds of the conjunctiva.

Extraordinary good results in the treatment of the gonococcal ophthalmia of the newborn are reported from the Berne University Eye Clinic by Siegrist and Schenderowitz<sup>1</sup> from the use of collargol and syrgol; the former in 3 per cent., the latter in 5 per cent. solutions. These were applied at first every hour; later, every two or three hours, after flushing the conjunctiva with warm boric acid solution. Neither drug showed any decided therapeutic advantage over the other. Collargol has the disadvantage of its dark color staining the secretions and dressings. On the other hand, syrgol sometimes produces an offensive diarrhea, probably by its direct passage into the gastro-intestinal tract.

**Squirrel-plague Conjunctivitis.** This disease is of especial importance because of the severe general symptoms that attend it, and the evidence it gives that man is subject to the attack of a widely distributed disease of our native rodents. It is probable that epidemics of the so-called squirrel plague are not confined to California, Kentucky, Ohio, and Indiana, where they have been recognized; and because the condition is not looked for in other places, it may often escape notice. The carefully studied case of Sattler,<sup>2</sup> with the experimental work done by Wherry and Lamb, tends to fill in the gaps that previously existed in our knowledge of this subject.<sup>3</sup>

Sattler's patient was a woman, aged forty-three years, who had been in contact with rabbits, in a portion of Indiana where the disease was known to be epidemic. The general symptoms included pyrexia, 104°, delirium, rigors, thirst, and pains in the limbs. There was marked swelling in front of the left ear extending to the jaw and neck. The left eye only was affected. The lids were edematous, bulbar conjunctiva chemotic, cornea clear. On the palpebral conjunctiva were seven distinct points of infiltration the size of a split pea, resembling pustules which had ruptured, becoming shallow ulcers, each with a grayish-white base. Constitutional symptoms continued for five weeks with variations in the glandular swellings, but the ocular symptoms disappeared somewhat earlier.

Secretion from the eye mixed with sodium chlorid solution was used to inoculate the peritoneum of a guinea-pig. The animal died in six days with lesions of the squirrel plague; and smears obtained from the spleen and liver gave organisms having the appearance of the *bacillus tularensis*. Cultures were obtained only upon coagulated egg-yolk. These rubbed into the conjunctiva of the rabbit produced

<sup>1</sup> Klinische Monatsblätter f. Augenheilkunde, 1915, liv, p. 228.

<sup>2</sup> Archives of Ophthalmology, 1915, vol. xxxiv, p. 265.

<sup>3</sup> PROGRESSIVE MEDICINE, JUNE, 1915, p. 416.

characteristic lesions, and the animal died of the disease on the fifth day. A caseated node excised at a later stage of the disease presented the appearance of a granuloma, but caused no infection in the guinea-pig.

**Vernal Conjunctivitis.** This condition, of obscure climatic origin, occurs rather frequently without being recognized. In this country the palpebral form is the more common in the white race, and is rather often confused with trachoma. Many observers have believed that the disease was rare among negroes. Roy pointed out ten years ago that the bulbar form in which there is marked thickening of the tissue at the corneal limbus was not very rare among negroes. It was then suggested that the cases he regarded as of this character were phlyctenular, the negro being prone to phlyctenular disease. Roy<sup>1</sup> has now recorded the results of his additional experience, which seems to demonstrate that his view is correct. In the ten years he has encountered 100 cases in the negro: all of them of the bulbar form. The band of thickened tissue at the corneal margin was widest, sometimes 4 mm. above and below. The majority of his cases occurred between six and twelve years of age. In the white race the majority of cases occur in males. But in the negro, Roy finds they are equally divided between the two sexes. Microscopic examination of excised masses demonstrated the same pathologic histology as had been observed in the white race, including the large proportion of eosinophile cells noted by Herbert and Brown Pusey.<sup>2</sup>

The treatment found best, included surgical removal of the hyperplasia, where the ring was very broad and not accompanied by a marked acute inflammatory congestion. After such removal, or in milder cases without it, the use of a mild wash of sulphate of zinc with adrenalin chloride, and the daily massage of the eyeball with yellow ointment proved the best treatment. This seemed to arrest the progress of the disease and keep the severe symptoms under control until cool weather; and under such treatment the severity of the symptoms decreased each season, until, after three or four years, there was very little trouble. To remove the circumcorneal hyperplasia the gelatinous masses were shaved off with a knife and the raw surface touched with a strong solution of silver nitrate.

In Palestine, Ticho<sup>3</sup> observed 28 cases of the bulbar form, and 4 of the mixed type. In that climate the clinical symptoms often make their appearance in February, increasing until they reach the maximum in June or July. Ticho also shaved off the larger growths. In one case he observed rapid improvement from the wearing of air-tight goggles.

**Serpent Ulcer of the Cornea.** The infected creeping, or serpent ulcer of the cornea is one of the most serious results of slight corneal injuries. Bacteriologic studies made in many localities show that in the great

<sup>1</sup> Journal of Ophthalmology and Oto-Laryngology, 1915, p. 345.

<sup>2</sup> PROGRESSIVE MEDICINE, June, 1912, p. 362.

<sup>3</sup> Klinische Monatsblätter f. Augenheilkunde, 1915, vol. liv, p. 510.

mass of cases the organism that gives the ulcer its dangerous character is the pneumococcus. The specific treatment of pneumococcus ulcer by ethyl hydrocuprein (sold under the proprietary name of *optochin*) has been alluded to twice previously.<sup>1</sup> The experience and laboratory investigations recorded in the more recent literature confirm the high estimate of its value formed from the earlier papers. Morgenroth<sup>2</sup> holds that the anesthesia produced by the drug proves that a 1 per cent. solution rapidly penetrates the cornea and reaches the terminals of the sensory nerves. Laboratory experiments on the rabbit by the introduction of pneumococci into the cornea prove that in this situation the pneumococcus can be killed without damage to the cornea. For this purpose a subconjunctival injection of a  $\frac{1}{2}$  per cent. solution was particularly effective. Morgenroth quotes some fifteen writers whose clinical experience supports this view.

Cavara<sup>3</sup> gives details regarding 55 cases of *pneumococcus ulcer* of the cornea treated with this drug, less than one-third of which could be regarded as light cases. His results compare most favorably with those obtained with thermotherapy and the galvanocautery. Superficial ulcers were rapidly and certainly cured by hourly instillations of a 1 per cent. solution, and in no case did the resulting scar extend beyond the original border of the ulcer. Hence the visual result is better by this method of treatment than by any other. Increased intra-ocular tension and infection of the lacrimal sac are not contraindications to its use. But these, with iritis and deeper infections of the eyeball, are favorably influenced by it. The instillation of a 1 per cent. solution causes some pain, which is quite bearable and passes off in a few minutes. Stronger solutions may be preceded by the application of cocaine. The solutions should be fresh. After two or three weeks it is said to be worthless. As Cavara points out, it is a method of treatment requiring no special apparatus or nursing, but may be successfully applied anywhere by the general practitioner. Basing their conclusions on results obtained in the cases of more severe infection, Axenfeld and Plocher<sup>4</sup> prefer to use a 2 per cent. solution, applied directly to the infected tissue.

Besides commending it in the treatment of corneal ulcers, Kraupa<sup>5</sup> suggests the use of optochin as a prophylactic. He suggests a 1 per cent. solution to be instilled in the eyes every second morning as a regular precaution on the part of workmen likely to be exposed to slight injuries of the cornea. This, he thinks, would cost the individual workman but little, and would save the nation from many being crippled by impaired vision.

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1914, p. 429; June, 1915, p. 419.

<sup>2</sup> American Journal of Ophthalmology, 1915, vol. xxxii, p. 40.

<sup>3</sup> Klinische Monatsblätter f. Augenheilkunde, June, 1915, p. 601.

<sup>4</sup> Deutsche med. Wehnschr., July 15, 1915, p. 845.

<sup>5</sup> Wehnschr. f. Therapie u. Hygiene des Auges, 1915, vol. xviii, p. 254.

**Keratitis.** INCISION FOR KERATITIS. As a last resort to check corneal suppuration many ophthalmic surgeons make an incision of the cornea. Apparently, the drainage of the cornea thus secured effects a radical change in its nutrition when nothing else will serve the purpose. Mayou<sup>1</sup> reports complete success by this method in a case of rodent ulcer, after prolonged treatment by other methods had failed. He made a corneal incision and reopened it daily for three weeks, and two months later repeated this. Usually the incision employed has been a straight one across the ulcer (Saemisch) or near the lower margin of the cornea. Foroni<sup>2</sup> has made an incision circumscribing the corneal lesion. He used the point of a cataract knife and divided the superficial layers of the cornea, being careful not to touch Descemet's membrane. This operation he has practiced in 200 cases including corneal abscess, suppurating ulcers, and rodent ulcers. If incision acts by promoting drainage of the tissue and influx of antibodies, this cutting around the lesion would give drainage and promote the inflow of lymph just where they are most needed.

**NEUROPATHIC KERATITIS.** It was pointed out years ago by Harlan that the term neuroparalytic keratitis, still used by a majority of writers, was a misnomer. The peculiar form of corneal inflammation found to accompany lesions of the fifth nerve is not caused when the nerve is entirely paralyzed, or is functionally destroyed by operation on the Gasserian ganglion. But the cornea does become affected when the nerve is not paralyzed, but involved in irritative lesions. Verhoeff<sup>3</sup> calls attention to the fact that with acute coryza, gastro-intestinal disturbances due to improper food, and even without apparent cause, lesions resembling corneal herpes occur near the corneal margin. They appear as round or oval infiltrates immediately beneath the surface, and vary in size from a fraction of a millimeter to several millimeters in diameter. They seldom undergo ulceration, but stain with fluorescein like other neuropathic lesions. As a rule, they are about  $1\frac{1}{2}$  mm. from the corneal margin, but sometimes are found 3 or 4 mm. on the cornea. Their position seems to correspond with the endings of the conjunctival nerves, which extend a little way upon the cornea. Rosacea keratitis often has a similar distribution and is regarded as neuropathic in origin. When farther out on the cornea, such lesions are of long standing and accompany the extension of the conjunctival vessels and presumably the conjunctival nerves to this region.

Believing such lesions are due to abnormal impulses, Verhoeff resorted to incision of the conjunctiva and subconjunctival tissue parallel to the corneal margin and extending beyond the region affected. The incision was made with scissors, dividing all tissue down to the sclera,

<sup>1</sup> Ophthalmoscope, 1915, vol. xiii, p. 438.

<sup>2</sup> Archiv f. Augenheilkunde, 1915, vol. lxxviii, p. 279.

<sup>3</sup> American Ophthalmological Society, 1915, vol. xiv, p. 89.

and the conjunctiva was undermined 4 or 5 mm. back from the cornea. Verhoeff also tried incising the superficial layers of the cornea with a cataract knife, but found the division of the episcleral tissue with the scissors equally effective. He terms this operation a *pericorneal neurectomy*.

**Blue Scleras.** The anomaly commonly spoken of as "blue sclerotics" is of general interest on account of association with brittleness of the bones. Its tendency to occur in families has been previously alluded to. Stephenson<sup>2</sup> investigated a family history in which twenty-one members belonging to four generations were thus affected; and three of these patients, a mother and two daughters, he especially reported upon. One of the daughters at two years of age broke a thigh by tumbling out of bed, and at four years of age broke her leg by falling as she ran across the kitchen floor. She had also sprained her ankle several times. Her sister, who had not broken any bones, had sprained both ankles on several occasions. Such a tendency to sprains and dislocations, as well as fractures, from very slight violence has been noted in many other cases.

Herrman and Fridenberg<sup>3</sup> report the case of a child who, when twenty months old, fell from an ordinary chair and broke its right tibia. Six weeks later, while in bed, it broke the right femur. A comparative röntgenogram was made by exposing side by side the leg of this child and that of a healthy child aged eighteen months. Comparison showed that the shadows were very much lighter from the limb of the patient; not only the shadows of the bones, but also the shadows of the soft parts; and this transparency of the tissues was found in all parts of the body. Apparently, connective tissue was lacking in the tendons, capsules of the joints, and the muscles, as well as in the bones.

Fridenberg suggests, however, that this general transparency of the tissues may be due to absence of lime salts. He thinks the color of the sclera is due more to transparency of the tissue than to actual thinning; and, in this particular case, the iris had the leaden gray color seen in early infancy. In this case, investigation showed no other member of the family had been similarly affected, two older children being quite normal. In a majority of the cases, so far reported, no family tendency has been traced. If the structural peculiarity is an acquired vice of nutrition, it may be found amenable to treatment.

#### PUPIL, UVEAL TRACT, AND GLAUCOMA.

**Pupil in Arteriosclerosis.** Wiener and Wolfner<sup>4</sup> call attention to a behavior of the pupil that they regard as at least suggestive of arterio-

<sup>1</sup> PROGRESSIVE MEDICINE, June, 1913, p. 420.

<sup>2</sup> Ophthalmological Society of the United Kingdom, 1915, vol. xxxv, p. 274.

<sup>3</sup> American Journal of Children's Diseases, 1915, vol. ix, p. 205.

<sup>4</sup> Journal of American Medical Association, 1915, vol. lxv, p. 214.

sclerosis. The pupil is larger than the average normal pupil, with a minimum of 4.5 to 5 mm. It contracts promptly to light stimulus, but immediately returns to its original size, and there remains. They record 11 cases in which the typical reaction was observed, and in which the blood-pressure varied from 125 to 250. In making the test for such a light reaction the intensity of the light, its distance, and the angle at which it strikes the eye, should be uniform.

**Secreting Structures of Ciliary Body.** While it is believed that from the ciliary body comes the essential part of the aqueous and nutrient fluid of the vitreous humor, the exact anatomy of these secretory structures has been in dispute. Treacher Collins described gland-like processes, which have been called the "glands of Collins." Alt found many such processes, but without the lumen which Collins had described.

Finnoff<sup>1</sup> has made a careful histologic study of the parts. He finds the ciliary processes generally covered with an outer (deep) pigmented layer of epithelium, and on this an inner unpigmented layer. Sections in a certain direction across one of the crypts of the ciliary body give the appearance of a gland with both layers of epithelium and a lumen. At other points layers of pigmented epithelium are present with cells grouped as in a gland, but without an apparent lumen, which, however, may arise as an artefact. The existence of the so-called glands of Collins is therefore doubtful. But it is likely that both layers of epithelium secrete the aqueous humor and nutrient fluid of the vitreous; the cells of the pigmented layer lying next to the blood channels playing, perhaps, the more active part.

**Gonorrhreal Iritis.** As rheumatism disappears from the list of common causes of iritis, gonococcus infection comes near to taking its place, following syphilis and tuberculosis in frequency; although other focal infections now known to be responsible for many of the cases formerly called chronic rheumatism share in this importance. The published statistics, as to the frequency of iritis due to the gonococcus, place it as from 2 to 15 per cent. of all cases of iritis. Most of these statistics are of little value because of failure to recognize the fact that gonorrhœa might cause iritis twenty, or even thirty, years after the acute infection, and because, until recently, no reliable test was available on which to base the diagnosis. Reber and Lawrence<sup>2</sup> urge that in every case of iritis a complement-fixation test for the gonococcus should be made, at the same time as a Wassermann reaction. They report cases in which the test was found positive, giving a basis for effective treatment five and fifteen years after infection. Keppeler's elaborate summary of the literature of the subject<sup>3</sup> makes it clear that, without such laboratory studies, a great many of these cases are classed as

<sup>1</sup> Archives of Ophthalmology, November, 1915, p. 626.

<sup>2</sup> Ophthalmic Record, 1915, vol. xxiv, p. 1.

<sup>3</sup> American Journal of Ophthalmology, 1915, pp. 332, 363.

"rheumatic." He emphasizes the fact that iritis due to this cause is often extremely acute, with a large amount of gelatinous exudate in the anterior chamber. But that it yields quickly to appropriate treatment, and often gives a remarkably complete recovery. This is illustrated by the cases of Reber and Lawrence, which were treated by injections of Neisser bacterin in large doses, 50,000,000 to 100,000,000 organisms. Pain was completely relieved in from three to six hours after the first injection, and the patient, whose vision was reduced to hand movements, recovered normal vision. De Schweinitz<sup>1</sup> has also been impressed with the good results that follow the administration of a Neisser bacterin in large doses. But he thinks there is a good deal of danger to the eye from the imprudent use of bacterial vaccines, having observed the development of uveitis, after repeated injections of a streptococcic vaccine, which gave the impression of being an anaphylactic uveitis, and subsided after the vaccine therapy was discontinued.

**Pathogenesis and Diagnosis of Uveitis.** To recognize the presence of an inflammation of the iris, ciliary body, or choroid, is usually not difficult. But this is only the beginning of diagnosis. The dominant fact regarding uveal inflammations is that they are not individual diseases in themselves, but manifestations of general departures from health; or closely associated with some focus of infection in a distant organ. Where the cause can be definitely recognized, it is, in nearly all cases, found to be some definite infection, and the determination of the pathogenesis constitutes the principal part of the diagnosis upon which the practical management of the case can be based.

The necessity of searching widely and persistently for the cause has been urged by de Schweinitz. In addition to the thorough investigation with regard to syphilis, tuberculosis and gonorrhea, the nose and nasal accessory sinuses, the mouth, teeth, gums and tonsils must be carefully examined for any possible focus of infection, which, by supplying bacteria or bacterial toxins, may be causing or keeping up the uveal inflammation.

Even when local symptoms are absent and the teeth seem normal, a röntgenogram has revealed a small abscess at the root of a tooth, and its drainage has proved the effective treatment for the uveitis. Bordley<sup>2</sup> has reported a case of the kind; and also a series of cases in which the greatest benefit was secured from thyroid feeding. He has treated 8 patients by this method; 4 with marked success, 2 doubtful success, and 2 with failure. The dose must be carefully graduated to suit the individual patient. With some, 5 grains of the extract can be given twice a day; with others, one-half grain twice a day is a full dose.

<sup>1</sup> Ophthalmic Record, December, 1915, p. 601.

<sup>2</sup> Transactions of American Ophthalmological Society, 1915, p. 232.

**Uveal Degeneration.** Wessely<sup>1</sup> believes he has demonstrated that cell poisons originating within the body may cause degenerative disease of the uveal tract and related parts. He injected bile salts and sterilized rabbit bile into the anterior chamber of the rabbit. In one case, at the end of two weeks, the iris had largely been destroyed, its remains being covered by new-formed connective tissue. After smaller doses, chronic degenerative changes were watched in the choroid, which seemed to undergo a sclerosis, and at the end of two years there was considerable bone formation. The retina and optic nerve gradually underwent atrophy, and cataract developed to an extent somewhat proportioned to the uveal changes.

**Atrophy of Iris.** Atrophy of portions of the iris from pressure, traction, or following injury, and general thinning of the iris in elderly people, are not very unusual. But in rare cases there occurs a gradual disappearance of almost the whole iris without antecedent disease, but accompanied or followed by increase in the tension of the eyeball. Such a case has previously been noticed;<sup>2</sup> and one equally striking is now reported by de Schweinitz.<sup>3</sup> His patient, a woman, aged twenty-three years, had suffered in childhood from glandular lesions, probably tuberculosis, and grave evidence of gastro-intestinal intoxication. The changes in the iris had been noticed for three years and included appearances of thinning, with one small gap near the margin. Six months later a second opening had formed, and both continued to increase in size. Gradually other openings appeared and merged into each other, until there remained only a strip of iris surrounding the enlarged pupil drawn to the nasal side, a narrow strand extending from this to the temporal side, and two small areas above and below. The whole area of iris remaining was less than one-fifth the normal. The eye-ground and field of vision were normal. Generally the tension of the eye was normal, but a few times was distinctly increased. De Schweinitz calls this condition one of essential progressive atrophy; and finds that the exact or even likely cause is not yet discovered. In the discussion of de Schweinitz's case, similar cases were referred to by Zentmayer and Mittendorf; and one somewhat related by Stieren. But the condition is rare, and, if early recognized, should be carefully studied with reference to possible causation.

**Sympathetic Ophthalmia.** In reply to a series of questions, thirteen of the leading German ophthalmologists have given their views and experience with regard to sympathetic ophthalmia and war injuries.<sup>4</sup> Nine of them based their views wholly on previous studies. Three found in their war experience evidence supporting the three theories

<sup>1</sup> Archiv f. Augenheilkunde, 1915, vol. lxxix, p. 1.

<sup>2</sup> PROGRESSIVE MEDICINE, June, 1911, p. 370.

<sup>3</sup> Transactions of American Ophthalmological Society, 1915, p. 250.

<sup>4</sup> Medicinische Klinik, 1915, vol. xi, pp. 360, 425.

of the disease they had previously held, and one, in his war experience, had noticed headache as a symptom, making its appearance in the third week. This lack of experience during the present war agrees with the absence of cases observed in the English and French services.

As to the points brought up, all united in the view that perforating injuries in the eyeball not followed by suppuration were most likely to produce sympathetic ophthalmia. The danger was greater if a foreign body remained in the globe, or if the uveal tract was particularly involved in the injury. As to indications for enucleation of an injured eye to prevent sympathetic ophthalmia of the other, blindness, low-grade uveitis, tenderness, failing vision, retained foreign body, and scar near the ciliary body, were mentioned. The period of safety from sympathetic ophthalmia that might be allowed before enucleation of an injured eye was variously estimated at from one to three weeks, with a majority placing it at two weeks. As to the first sign of impending sympathetic ophthalmia, there was much disagreement, although a majority included ciliary injection. As to the first signs of actual sympathetic ophthalmia, precipitates on Descemet's membrane, ciliary congestion, and optic neuritis were almost equally regarded. As to enucleation of the injured eye after sympathetic ophthalmia had developed, all agreed it should be done if the eye were blind, and two favored it without qualification. As to treatment, seven placed mercurial inunctions first, six advocated sodium salicylate, and four were using salvarsan.

Jampolsky<sup>1</sup> reports, from the clinic of Professor Fuchs, 8 cases in which sympathetic ophthalmia occurred after enucleation of the injured eye. In one of these the eye was enucleated eighteen days after the injury, and the sympathetic disease began twelve days after that. The longest period after enucleation in which sympathetic disease began was thirty-eight days, twenty-nine days having elapsed between the time of injury and enucleation. In addition, 33 cases are gathered from the literature. The summary of ultimate results in these cases fully supports the conclusion of the Committee of the Ophthalmological Society of the United Kingdom; that, after such removal of the injured eye, the prognosis is much better than where the sympathetic disease has appeared before removal of the injured eye. Of the whole group, 60 per cent. recovered good vision.

**Glaucomatous Excavation.** To distinguish between simple glaucoma and optic atrophy with excavation, is one of the older problems of modern ophthalmology. It is still a question if the distinction ought to be made. Cases of simple glaucoma can run their course with such slight and brief increase of intra-ocular pressure, and the symptoms are otherwise so similar, that the cases which it has been attempted to divide into groups may be essentially the same. Morax<sup>2</sup> reports 5

<sup>1</sup> Zeitschrift f. Augenheilkunde, 1915, vol. xxxii, p. 233.

<sup>2</sup> Annales d'Oculistique, 1916, vol. cliii, p. 25.

of these borderline cases, in none of which was the intraocular tension observed to reach the upper normal limit. Two were submitted to glaucoma operations. In 1, it was not advised even to use miotics. He concludes that atrophy with excavation should be distinguished from glaucoma, the latter being accompanied with a diminished intra-ocular tension, slowly progressive; and its course not influenced by pilocarpin or other measures to reduce intra-ocular tension. Rather in opposition to the above views are the observations of Gilbert,<sup>1</sup> who reports a study of 5 cases of both simple and hemorrhagic glaucoma. In these, the cavity formation that has been held responsible for the deep excavation of the optic disk in cases of atrophy with excavation, was found both in advanced and early stages. He suggests the resemblance of the process to *syringomyelia*. He found in the optic nerves, as an early stage in the disease, masses of blood corpuscles, round cells, and debris of the nervous tissue, which later gave place to cavities, such as cause the optic nerve excavation. The obliteration of small arteries by proliferation of the intima, and the edema of periphlebitis seemed to point toward a vascular origin for the process.

**Glaucoma Operations.** As to the treatment of glaucoma, while the interest in the newer operations still continues, it seems to be no longer increasing. The present status of the operation for trephining is fairly indicated by the statement of Butler:<sup>2</sup> "The tide of sclerotomy has reached high-water mark, but even now signs are not wanting that the ebb has commenced. It may even be that iridectomy, which has been widely condemned, I think, upon wholly insufficient evidence, may once more become the usual operation for all kinds of glaucoma."

Butler discusses the objections to both iridectomy and sclerotomy and finds the latter are the more serious. The immediate objections are that sclerotomy is more difficult. He points out that any one can make a hole in the eye, but the correct trephine operation demands much thought, care, and skill. The results, too, are unreliable, and the operation is more likely to be followed by iritis. But late infection he calls "the tragedy of sclerotomy." It has entirely altered his opinion about the operation. He thinks that sclerotomy should be reserved for cases in which iridectomy has failed, or in which the anterior chamber is so shallow that iridectomy is technically more difficult than trephining; or where, on account of atrophy of the iris, iridectomy is manifestly futile.

Lundsgaard's<sup>3</sup> experience of 40 cases of *trephining* seems to indicate that the results are better if iridectomy is done with it. It is an operation not without danger, and he hesitates to resort to it for secondary glaucoma. Axenfeld<sup>4</sup> again emphasizes the danger of late infection after

<sup>1</sup> Graefe's Archiv f. Ophthalmologie, 1915, vol. xe, p. 76.

<sup>2</sup> Archives of Ophthalmology, 1915, vol. xlii, p. 611.

<sup>3</sup> Klinische Monatsblätter f. Augenheilkunde, 1915, v. lix, p. 209.   <sup>4</sup> Ibid., p. 264.

trehphining. He has, himself, had 4 cases following after faultless operations, and finds more than 30 published in the recent literature. It may be a necessary remedy in severe chronic glaucoma, but, on account of the later sequels, he would not do it on young patients who might be relieved in any other way. Woodruff,<sup>1</sup> whose experience includes 20 cases of his own, and observation of a similar number in the hands of a colleague, suggests a careful study of the individual case, using the operation of iridectomy where there is a reasonable chance of success, and resorting to the trephine in cases of necessity only.

The operation of *iridotasis*, devised by Borthen, has been done by Harrower<sup>2</sup> in 7 cases, with ultimate good result in all of them. It consists in raising a large conjunctival flap, entering the periphery of the anterior chamber through a keratome incision 4 or 5 mm. long, drawing out the iris and leaving it everted and incarcerated in the incision and under the conjunctiva. Roy<sup>3</sup> reports a similar favorable experience, having done iridotasis on 9 eyes, in five patients, with relief of symptoms, and improvement in vision in the less advanced cases. He quotes a personal letter from Borthen stating that he had performed iridotasis in 242 cases with results so satisfactory that he is not inclined to try any other operation. He believes the good results are due to improved drainage through stretching of the iris. In the discussion of Harrower's paper, the dangers of thus incarcerating the iris were strongly dwelt upon. But there seems to have been a general failure to make the proper discrimination between subconjunctival and exposed prolapses of the iris. The former probably are not subject to the dangers of subsequent infection, that attend a prolapse of the iris into a corneal wound or perforating ulcer.

Faith in the safety of what may be done or retained beneath a covering of sound conjunctiva, has led to the trial of two new operations to lower intra-ocular tension. Wood<sup>4</sup> has devised a method of placing a *sclero-corneal seton*. A narrow Graefe knife, with a hole near its point, is thrust through the periphery of the anterior chamber as for anterior sclerotomy. When the point has emerged after the counter-puncture, a braided silk suture is threaded through the hole, and, in withdrawing the knife, the suture is carried back through the periphery of the anterior chamber. The suture is then freed from the knife, and each end threaded to a half curved needle, by which the ends are carried from the knife puncture, under the conjunctiva toward the equator of the eye, and cut short at the new point of emergence from the conjunctiva. Wood reports one case of secondary glaucoma, in which, after failure of iridectomy and trephining, the seton proved effective.

<sup>1</sup> Annals of Ophthalmology, 1916, vol. xxv, p. 1.

<sup>2</sup> American Ophthalmological Society, 1915, p. 55.

<sup>3</sup> Ophthalmic Record, 1916, vol. xxv, p. 129.

<sup>4</sup> Ibid., 1915, vol. xxiv, p. 235.

Prince<sup>1</sup> has devised what he calls a "Mule-shoe drain" for glaucoma. It consists of a ring of pure gold, 2.5 mm. in diameter, made of No. 30 B. and S. gauge wire, with a toe attached to one side of the ring. After raising a conjunctival flap, a keratome incision or trephine opening is made, entering the angle of the anterior chamber, and the ring placed with the toe in this opening to make permanent the drainage. This he has tried several times with good results. Such operations are suggestive of possible resources that may be of great value in unusual cases. It is not likely that they will supersede other glaucoma operations to any important extent.

### THE CRYSTALLINE LENS.

**Cataract Caused by Lightning Stroke.** Exposure to lightning stroke, or the high tension electric currents used in the industries, is a well-known cause of cataract. Probably slight injury of the kind to the crystalline lens is a more common form of electric injury than may be generally realized. Löwenstein<sup>2</sup> reports 5 cases of slight partial opacity involving eight eyes. A study of these partial opacities seems to throw some light on the character of the lesion. He found, in general, the clouding located near, or to the nasal side of, the posterior pole of the lens. The appearance was of a gray, rounded patch, which, on close examination, with a strong convex lens, was found punctate in character. He suggests that concentration at this point of current, having an electrolytic action, accounts for the lesion. Seen within twenty-four hours after the injury, the opacity was distinctly visible; and, in seven of the eight eyes, no alteration in the appearance occurred while under observation. Some of the patients presented burns of the skin, but in others no such external injury was found, and most of them were free from any paralysis. The mental disturbance varied from momentary confusion to unconsciousness, lasting four hours.

**Treating Early Senile Cataract.** The removal of cataract without operation is so greatly and persistently desired by patients, that the claim to accomplish it will always open an attractive field to the charlatan. Probably fifty people have early cataract to one who ever requires operation. So the field for real or pretended cure is an important one. The prognosis of these cases was referred to last year.<sup>3</sup> In view of the uncertainty as to the development of cataract, even without treatment, the course of a few cases treated by any particular method throws very little light upon its real value. Even extensive statistics may be worth very little, because of the great difficulty of remembering the objective appearance of a lens opacity or reproducing it in a clinical sketch; and

<sup>1</sup> Annals of Ophthalmology, 1916, vol. xxv, p. 8.

<sup>2</sup> Klinische Monatsblätter f. Augenheilkunde, November-December, 1915, p. 594.

<sup>3</sup> PROGRESSIVE MEDICINE, June, 1915, p. 426.

the changes in acuteness of vision, which in these cases varies considerably from day to day without any real change in the state of the cataract. All these things must be borne in mind in estimating the value of evidence regarding the medical treatment of cataract. But, if something may be accomplished along this line, it is important that the profession should know it, if only to combat the influence of quacks.

Pollock<sup>1</sup> has reported 100 cases of partial cataract, 178 eyes, submitted to this treatment. Eye-baths of "strong solutions" of potassium iodide and sodium chloride were applied for five minutes three times daily. After the application, solutions of dionin, fibrolysin, or iodolysin were instilled. These latter were used at first in weak solutions, with the strength gradually increased until any further increase would produce too great a reaction. Then that particular drug was discontinued, and one of the others used in its place. Attention was given to the general health, and in many of the cases potassium, or sodium, acetate or citrate were administered internally. The cases reported had been under treatment for periods varying from three months to seven years. Forty-four per cent. of the eyes showed "great improvement;" 41 per cent. some improvement; 7 per cent. remained stationary; and in 8 per cent. the cataract had continued to increase. Cases presenting cortical striae showed the most improvement; nuclear opacities were the most difficult to benefit. The treatment lasted, as a rule, from six to nine months, and in some cases relapses occurred. The scientific reputation of its author will secure for this paper the attention it deserves, but the lack of exact statements regarding the solutions employed, and the failure to exclude the influences of changes in refraction, which are known to be common and important in cases of partial cataract, detract from its value.

**Cataract Operations.** Modifications of the operative treatment of cataract give rise to an enormous amount of literature. But the new ideas this literature brings forward are few and far between. An original method of cataract extraction has been suggested by Krückmann.<sup>2</sup> With the pupil widely dilated, he introduces a knife needle 3 mm. to the temporal side of the corneal margin. With this, a vertical cut is made in the anterior capsule and cortex of the lens, from the upper to the lower margin of the pupil. Then a horizontal cut is made in the capsule and cortex, across the whole width of the pupil. Having thus opened the lens, he depresses the point of the needle and pushes it back of the lens nucleus; using the needle as a lever, he dislocates the lens nucleus forward into the anterior chamber. After this, an incision is made with a lance knife, entering 3 mm. above the corneal margin, through which the dislocated nucleus and cortical masses are pressed out. It is a method that cannot be relied on to remove the lens cortex

<sup>1</sup> Transactions of Ophthalmological Society of United Kingdom, 1915, p. 331.

<sup>2</sup> Graefe's Archiv f. Ophthalmologie, 1915, vol. xc, p. 322.

very completely; usually a subsequent needling must be expected. But a comparatively small nucleus could thus be removed with an incision that would be likely to heal quickly.

As a rule, the methods of disinfection applicable to the skin, are not to be resorted to in the conjunctiva. However, for the needling of cataract, Verhoeff<sup>1</sup> has used tincture of iodin. After the eye has been cocainized, the point where the needle is to be introduced is dried with cotton, and then touched with a small amount of cotton dipped in tincture of iodin. Verhoeff states that the application of the iodin may be made to the cornea, but he takes the wise precaution of making the puncture through the conjunctival limbus.

#### RETINA, OPTIC NERVE, VISUAL TRACTS AND CENTRES.

**Hemeralopia.** This has attracted considerable attention in the German armies, and has constituted a real disability for service in night attacks. Braunschweig<sup>2</sup> found 22 cases among 98 hospital patients suffering from eye diseases. In two-thirds of these cases the condition was ascribed to errors of refraction, and the patients felt much better after their correction. In addition, liberal diet, rest, and tonics, with undisturbed sleep, brought about recovery. Best,<sup>3</sup> who examined 36 cases, also found two-thirds of them due to errors of refraction. Most important of other causes were hunger and emaciation. Cases due to these causes also improved with improved hygiene, as did hemeralopia following night service in the trenches. Many patients traced their symptoms to strain of the eyes caused by peering through darkness. Paul,<sup>4</sup> who saw 16 cases, and noted the same clinical facts as the other observers, believes that the war form of night-blindness is not an eye disease, but rather a cerebral disturbance, consequent upon nervous relaxation and psychic depression; and treatment must be directed to repair of the nervous or psychic injury.

On the other hand, Augstein,<sup>5</sup> from an experience of 58 cases, concludes that idiopathic hemeralopia, or hemeralopia through disturbances of nutrition, is really a nutritive fault of the choroid, and attended with characteristic changes in the eye-ground. These divergent views are to be reconciled on the supposition that undue weight has been given to ophthalmoscopic appearances, an explanation supported by analogy from the history of many forms of retinal disease. But to a large extent they may be accounted for by the fact that night-blindness is a symptom which may arise in connection with quite different

<sup>1</sup> Ophthalmoscope, 1915, vol. xiii, p. 631.

<sup>2</sup> Münchener medicinische Wehnsehr., March 2, 1915.

<sup>3</sup> Ibid., April 17, 1915.

<sup>4</sup> Ibid., 1915, No. 45.

<sup>5</sup> Klinische Monatsblätter f. Augenheilkunde, November-December, 1915, p. 474.

conditions, and that more than one important factor is concerned in its production.

**Retinal Tuberculosis.** The tendency to hemorrhage in early tuberculosis is exhibited in lesions of the retina. Otori<sup>1</sup> studied two eyes enucleated for hemorrhagic inflammation and hemorrhagic glaucoma with iritis. In both, the retina was extensively destroyed, and tubercle bacilli were found in the tissue that was relatively but little damaged. They were most numerous in masses of round cells that had accumulated along the retinal veins. Otori also injected bacilli into the common carotid of the rabbit, but was not in this way able to produce a primary retinal tuberculosis. He believes the retina has a natural resistance to primary tuberculous infection, the clinical cases arising by way of perivasculitis. Jackson<sup>2</sup> reports two cases that seem to connect tuberculosis with primary retinal hemorrhage in young persons. In these cases, both a general and a focal reaction were obtained by tuberculin injections; and by tuberculin therapy all active disease was removed. Both patients had remained free from hemorrhage for eight and twelve months respectively. The vision had improved in one case from counting fingers to 0.4, and in the other from 0.1 to normal. The relative cure was brought about by the formation of connective tissue giving rise to the ophthalmoscopic picture of *retinitis proliferans*.

**Detachment of the Retina.** The old theories to account for retinal detachment, *viz.*: (1) A fluid pushing the retina from the choroid; (2) contraction of the vitreous drawing it away; and (3) osmosis transferring fluid from the vitreous to the subretinal space, are each invoked to support different methods of treatment. But the essential basis of treatment remains empirical. The value of the large amount of literature given to this subject in the past year lies wholly in the recorded clinical experience of its authors. Ramsay<sup>3</sup> points out that the restoration of the retina to its proper position, is not the same thing as restoring the sight. He mentions a patient who returned for progressively diminishing vision, in whom the retina was found to have resumed its normal position. The line of treatment he pursues includes the following: Absolute rest in bed for four to six weeks. The pressure bandage applied to each eye, so that it will be distinctly felt. Cases intolerant of this have a bad prognosis. Subconjunctival injections of sodium chlorid; diaphoresis by pilocarpin; and scleral puncture to draw off subretinal fluid, rather as an adjunct to the non-operative treatment.

On the other hand, Paton<sup>4</sup> has practiced *postequatorial galvanopuncture of the sclerotic*. After doing this, he has seen the retina return

<sup>1</sup> Archiv f. Augenheilkunde, 1915, vol. xevii, p. 44.

<sup>2</sup> Annals of Ophthalmology, 1916, vol. xxv, p. 84.

<sup>3</sup> Transactions of Ophthalmological Society of United Kingdom, 1915, vol. xxxvi, p. 69.

<sup>4</sup> Ibid., p. 86.

to its normal position about the seat of perforation. But with this it was dragged away from the choroid on the opposite side, apparently by bands in the vitreous. He reports a case of supposed sympathetic origin, the other eye having been lost by traumatic detachment of the retina thirty-three years before. Three galvano-punctures were followed by restoration of standard vision. Paton cauterizes the sclera with a very dull red heat, and advances slowly with the idea of cauterizing the vessels. After "trenching the sclera instead of making a hole," he aspirates with a lacrimal syringe. Jones<sup>1</sup> reports a case of cure, in which after piercing the sclera with the galvanocautery, a subconjunctival injection of mercury cyanide, with dionin and morphin was given. The conjunctiva being drawn aside during the puncture, the scleral opening became subconjunctival, when the eye was released.

Thomson and Curtin<sup>2</sup> have trephined the sclera, and have subsequently aspirated the subretinal space. The lower lid is retracted with a strabismus hook, and a conjunctival flap, with its convexity toward the cornea, is made over the temporal or nasal side of the inferior rectus. All tissue is divided down to the sclera, and a suture at once placed in the apex of the flap to draw it out of the way; and especially to make sure that the subconjunctival tissue is included in the suture, and not allowed to retract so as to subsequently fill or conceal the trephine opening. If perforation of the sclera is followed by free escape of fluid from the suprachoroidal space, the operation is carried no farther at the time, but the flap sutured in place and the patient put to bed. Some days later the needle of an aspirating syringe is thrust into the opening and through the choroid, and the subretinal fluid drawn off, sometimes to the amount of 30 minimis, or more. This aspiration may be repeated from time to time, and seems to cause very little reaction.

Parker,<sup>3</sup> who has previously called attention to the operation, after removing the button of sclera, penetrates the choroid with the point of a Graefe knife. In his most successful cases he also allowed the escape of a small amount of vitreous. This patient's vision was improved from 4/60 to 4/5; the field made practically normal, and this result was maintained after seventeen months. He reports 11 cases whose central vision was improved in 4, unimproved in 5, and made worse in 2. The fields of vision were improved in 8, and made worse in 3. Single successful cases are reported by Ohm,<sup>4</sup> and von Hippel.<sup>5</sup> The former trephining the sclera 9 mm. back from the cornea; and the latter dividing a

<sup>1</sup> Annals of Ophthalmology, 1915, vol. xxiv, p. 491.

<sup>2</sup> Transactions of Section on Ophthalmology of American Medical Association, 1915, p. 87.

<sup>3</sup> Ibid., p. 106.

<sup>4</sup> Zeitschrift f. Augenheilkunde, 1915, vol. xxxiii, p. 288.

<sup>5</sup> Klinische Monatsblätter f. Augenheilkunde, 1915, vol. lv, p. 146.

contracting band in the vitreous humor, allowing the retina to take its normal position in four days with the good result maintained a year later.

**Glioma of Retina.** Bilateral glioma of the retina raises one of the most appalling questions with which the surgeon is confronted. A number of cases are on record in which both eyes have been removed and the patients' lives thereby saved. When both eyes are already blind, this is a rational procedure to be strongly urged. But the removal from a child of an eye, having good vision, when the other eye has already been lost, is a procedure that scarcely any parent will permit. Two cases are now reported in which the seeing eye was saved, without sacrificing the patient's life. Axenfeld<sup>1</sup> saw a child, eight months old, with a typical blind, gliomatous eye. It was removed and the diagnosis confirmed by microscopic examination. With the ophthalmoscope, during the narcosis required for the operation, three gliomatous nodules were found in the retina of the other eye. Enucleation was refused, and the eye was given four intensive exposures to the Röntgen ray, and a twelve-hour intensive exposure to mesothorium rays. Two months later the gliomatous nodules showed distinct retrogressive changes. The Röntgen-ray exposures were continued over a period of ten months, with periodic ophthalmoscopic examinations made, like the first, during narcosis. The gliomatous tumors steadily decreased, and the vision of the eye, as indicated by fixation, seemed to improve.

A somewhat similar case is reported by Meller.<sup>2</sup> A boy, aged four years, was brought with the right eye blind from glioma. It was removed, and the diagnosis confirmed by the microscope. In the left eye were found, with the ophthalmoscope, three circumscribed nodules of apparently similar tumor formation. One of them protruded into the vitreous and contained large tortuous vessels. Removal of this eye being refused, it was exposed twice to the Röntgen rays, and potassium iodid was given internally. A year later the growths were believed to have increased somewhat in size; but, in the year after that, no change was found. Almost five years after he was first seen, when it was supposed he had been long dead, the boy was brought back in good health, his eyes possessing normal vision, with the foci of disease in the retina flattened, atrophic, chalk-like white masses, devoid of vessels. Exposure to the Röntgen rays is less dangerous to the ocular tissues than was at first supposed, and the desperate character of these cases, without some such remedy, fully justifies its trial in any case of glioma, in which immediate removal of the eyeball cannot be practiced; particularly in the better eye of a bilateral case.

**Anomalies of Optic Nerve Head.** Several atlases of ophthalmoscopy contain pictures of cases in which the optic disk seems to be partly

<sup>1</sup> Klinische Monatsblätter f. Augenheilkunde, 1915, vol. liv, p. 61.

<sup>2</sup> Centralblatt f. praktische Augenheilkunde, May, 1915, p. 101.

concealed—the usual appearance of the retina extending over a portion of it. Schwartz<sup>1</sup> reports a case in which the only appearance of an optic disk was a white spot, two or three times the diameter of the largest retinal vessels; which emerged in its immediate neighborhood. Both eyes presented these appearances. Vision with correcting lenses was 6/12. The fields of vision were greatly limited; the nasal half of each field being almost obliterated, and the greatest extension of the temporal field being 40 or 50 degrees.

Goldenburg<sup>2</sup> reports a case quite similar to the above, except that the region to which the retinal vessels converged was deeply pigmented. The patient was a young negro. In front of the largest branch of the central retinal artery was a white spot not much wider than the artery. The vision with correcting lenses was: Right 20/40; left 20/25. The visual fields were contracted, but lacked the hemianopic character of those in the previous case.

Occasionally a deep pit is found in the optic disks quite apart from the normal physiologic excavation. Often the depth of such a pit can be measured with the ophthalmoscope, but occasionally this is not possible on account of a veil that seems to extend across it. Holloway<sup>3</sup> reports a case in which the gray veil covering the supposed excavation showed a pulsating reflex.

**Optic Neuritis and General Disease.** The importance of choked disk in coarse disease of the brain (tumor, abscess, hemorrhage, etc.,) is generally understood. But many fail to appreciate how often optic neuritis is an important lesion of many general diseases. Clouting<sup>4</sup> reports a case of optic neuritis found in a boy suffering from unusually severe whooping cough. The neuritis was bilateral, and there was a history of the boy having struck his head, but there was an entire absence of cerebral symptoms, so that the immediate cause of the neuritis, whether it was toxic, due to hemorrhage, meningitis, or encephalitis, remained uncertain.

An instance of acute axial optic neuritis as the first symptom of disseminated insular sclerosis, is reported by Shumway.<sup>5</sup> An otherwise healthy man, aged twenty-nine years, noticed failing vision in his left eye. Examination showed a central scotoma. He had never used tobacco, or intoxicating beverages. In the nose there was a necrosing ethmoiditis, which was treated, and vision improved from 2/45 to 6/12. A year later he complained of some weakness in the right hand, leg, and thigh; and three years after that sought advice for similar symptoms which had disappeared and reappeared, being always worse when he

<sup>1</sup> Graefe's Archiv f. Ophthalmologie, 1915, vol. lxxxx, p. 326.

<sup>2</sup> Archives of Ophthalmology, 1915, vol. xliv, p. 246.

<sup>3</sup> Ophthalmic Record, 1915, vol. xxiv, p. 250.

<sup>4</sup> New York Medical Journal, 1915, vol. ci, p. 1051.

<sup>5</sup> Ophthalmic Record, 1915, vol. xxiv, p. 385.

was tired or nervous. Seven years after noticing the impairment of vision from optic disease, he presented well-marked symptoms of insular sclerosis. Tschirkowsky<sup>1</sup> reports the case of a peasant previously healthy, but dying of acute disseminated sclerosis. Blindness with dilated pupils appeared, with aphasia and paresis of the right arm and both legs. The ophthalmoscope showed severe papilledema. Death occurred in about two weeks. The changes characteristic of disseminated sclerosis were found throughout the whole extent of the optic nerves and chiasm. Papilledema due to war injuries will be referred to under the head of injuries.

### LIDS, LACRIMAL APPARATUS, AND ORBIT.

**Xeroderma Pigmentosa.** *Kaposi's Disease.* This rare disease of unknown etiology becomes of great practical importance when it involves the lids or eyeball. Its tendency to involve the different children of a family is illustrated by cases reported by Cross<sup>2</sup> and Dean.<sup>3</sup> The patients of the former were a boy, of eleven, and his sister eighteen months younger. Freckles began to appear on the exposed parts of the body of each when nine months old; and nodular growths on the girl at eighteen months, and the boy between two and three years. These at first fell off, leaving no scar; but other swellings appeared, and the skin became dry, parched, thin, and tightly drawn. At four years of age the boy had a growth on the cornea. Both corneas were thus affected when he was eleven, and a year later he came with a papilloma as large as a pea protruding between the lids. The girl had early involvement of the edge of the lid, causing deformity, and on one cornea an extensive infiltration.

Dean saw two members of a family: A girl, aged eight, and a boy, aged six years; an older sister, who had died at the age of twelve years, was similarly affected. Another brother and two sisters were healthy. Dean also gives the case of a woman, aged twenty-eight years, whose trouble began with an eruption on the face, neck and hands following exposure to direct sunlight when nine months old. Lesions were present on all four of the eyelids, involving the lid margins. This patient died one year later, apparently from the progress of the disease. While the prognosis as to cure is entirely unfavorable, much can be done to relieve the eye symptoms. Photophobia is persistent, and often extreme; but is relieved by protection of the eyes, ordinary treatment for conjunctivitis, and removal of all growths from between the lids. Deformity of the lids can be largely prevented by appropriate measures.

<sup>1</sup> Klinische Monatsblätter f. Augenheilkunde, 1914, vol. liii, p. 529.

<sup>2</sup> Transactions of Ophthalmological Society of United Kingdom, 1915, vol. xxxvi, p. 202.

<sup>3</sup> Ophthalmology, 1915, p. 670.

**Blastomycosis of the Lids.** Blastomycetic dermatitis does not share the grave prognosis of systemic blastomycosis; being quite amenable to treatment. When it involves the lids, it will, if neglected, produce great deformity and even destruction of the eye. Jackson<sup>1</sup> reports a case that had gone from one adviser to another, without the nature of the disease being recognized, until, at the end of four years, one eye was blind, with opaque cornea, the lids having been entirely destroyed, and the whole conjunctiva everted. In the other eye the disease was beginning to cause deformity and ectropion of the upper lid. In this patient all active lesions healed within two months, under proper treatment. In a second case three ulcerating areas that developed on the lids of the right eye, had grown progressively worse for seven months under different specialists. They were completely healed in three weeks of appropriate treatment.

Fagin<sup>2</sup> reports a case of his own in which the lesions in the lids of the right eye had been progressive for two years. He was quite cured in three months. In addition, Fagin reports 5 other cases that have been recognized at Memphis. All but one occurred in colored men; in all of them, extensive scars involving the lids resulted. The treatment of the condition includes curetting and other methods for cleansing the diseased surface; exposures to  $\alpha$ -rays; and, most important, the *internal administration of potassium iodid in increasing doses*, as for late syphilis. The large groups of cases that have been reported by single observers make it certain that this disease is not very rare; and the reports indicate that it is widely distributed throughout the United States. Probably the majority of cases are still confused with carcinoma and syphilis, and rapid improvement under potassium iodid tends to confirm the latter error.

#### INJURIES.

**Staphylococcus Infections.** It is an unpleasant surprise to have a comparatively slight injury to the eyeball by a presumably aseptic body followed by serious infection and perhaps disorganization of the eyeball. In such cases the finding of the white staphylococcus in pure culture is not always accepted as a complete explanation of the misfortune. Because this is the most common saprophytic organism found in the conjunctiva. Epalza<sup>3</sup> has studied its hemolytic action, which Neisser and Wechsberg consider characteristic of pathogenicity. Some 17 strains of staphylococcus obtained from the conjunctiva were tested. Of these, 9 caused hemolysis, and 8 did not. Cultures from the latter strains were injected into the vitreous of the rabbit, and, after ten or

<sup>1</sup> Transactions of Section on Ophthalmology of American Medical Association, 1915, p. 28.

<sup>2</sup> Ophthalmoscope, 1915, vol. xiii, p. 426.

<sup>3</sup> Klinische Monatsblätter f. Augenheilkunde, 1915, vol. liv, p. 90.

twelve days, two of these were found to cause hemolysis. That a saprophyte carried into the vitreous may multiply and become pathogenic explains admirably the slow infections of the eyeball encountered after slight injuries. It is a possibility that should not be lost sight of in prognosis, and which may suggest effective treatment by a vaccine.

The pneumococcus is not rarely found in the normal conjunctiva. Rosenow<sup>1</sup> took a strain cultivated for eleven years in the laboratory and passed it through eighteen rabbits without producing eye lesions. In the nineteenth it caused an iritis, and next injected into a dog produced purulent conjunctivitis, iritis, and hemorrhages, and infiltration of the limbus. Experiments with colon bacilli and streptococci have given similar results.

**War Injuries.** The discussion on ophthalmic injuries in warfare, opened by Jessop and Lister,<sup>2</sup> is one of the best collections of observations relating to this subject among the large number that have been published within the last year. So many different surgeons have made the same important observation, or devised similar methods of meeting a certain difficulty that it is quite impossible here to give credit to all for their work. We will only attempt to summarize the important points of this extensive literature, giving individual credit in a few instances.

The peculiarities of injuries encountered in the present war are due chiefly to: (1) The use of rifles projecting bullets at enormous velocities, and rotating very rapidly; (2) the use of high explosives; and (3) the great amount of fighting done in trenches. When the bullet from a high power rifle enters the orbit with any large fraction of its initial velocity, the eyeball is almost invariably very badly damaged. When the bullet passes near the globe this is ruptured. If it penetrates the eyeball the sclera is ripped up, so that it resembles the corolla of a faded flower. In dealing with these cases, Lister recommends that each petal-like fragment be seized with forceps, drawn forward, dissected free from its muscular attachments and cut off 4 or 5 mm. in front of the optic nerve. This avoids opening the lymph space around the nerve, and diminishes the danger of cerebral infection. When a high velocity bullet passes near the eyeball the resulting concussion causes hemorrhage, and white areas of retinal exudate which may be seen with the ophthalmoscope. These latter clear up some, but leave the sight greatly impaired. Similar effects may be produced by the contusion of more slowly moving projectiles, as shrapnel.

Taylor<sup>3</sup> reports 3 cases of *rupture of the choroid* among these so-called concussion injuries. But Zorab<sup>4</sup> warns against danger in the concussion

<sup>1</sup> Journal of Infectious Diseases, 1915, vol. xvii, p. 403.

<sup>2</sup> Transactions of Ophthalmological Society of United Kingdom, 1915, vol. xxxv, p. 1.

<sup>3</sup> Ophthalmoscope, 1915, vol. xiii, p. 598.

<sup>4</sup> Ibid., vol. xiii, p. 597.

rupture diagnosis. He reports a case of blindness from sympathetic ophthalmia where the injured eye, on removal, showed a small puncture, probably from a spicule of bone. In another case, after the vitreous had cleared, three small pieces of metal were visible with the ophthalmoscope. In this case the eye, being quiet, was left undisturbed. Dantrelle<sup>1</sup> records a series of cases in which the lesion was strikingly limited to the region of the fovea, causing a definite central scotoma.

The foreign bodies found in the eyeball are commonly small, often very numerous, and of the most varied character. Sometimes they are bits of steel or nickel chipped from the jacket of a bullet, sometimes "splashes" of lead, often the sand or gravel thrown up by the high explosive of a shell, sometimes splinters of wood, and bits of clothing are found, and in 1 case a fragment from a comrade's skull. Cosmetatos,<sup>2</sup> among 39 cases, saw 35 due to bits of stone, and 4 to splinters of wood. Nearly all are non-magnetic, and their extraction practically impossible. When extraction of a particle embedded in the cornea is attempted, it will often be done with the least damage by cutting down upon it with a cataract knife. Often the question has been between leaving it alone and enucleating the eye. As has been found in certain classes of mining injuries, the cornea and other tissues of the eye may be remarkably tolerant of these multiple foreign bodies. Some eyes get quiet and remain so, retaining vision that may be useful. If the globe becomes soft, and its inflammation tends to be chronic, it must be enucleated. Probably wisdom in this respect accounts for the fact, according to Jessop, Darier<sup>3</sup> and others, that in this war comparatively few cases of sympathetic ophthalmia have arisen. In a relatively large number of cases a bullet had passed through both orbits, destroying the sight of both eyes. Jessop points out that while only 28 such cases were recorded in the Franco-German war, at least 50 had been recorded in the first eight months of the present struggle. Ormond<sup>4</sup> has published a tabular report of 28 cases of double blindness mostly of this character. The brain not being penetrated, most of these cases survive, making the proportion of soldiers left blind very large. Such injuries occur from the operations of snipers, or where a trench has been enfiladed; the trench warfare causing the very large proportion of head injuries.

The treatment of war injuries of the eye and orbit has been complicated, by common and severe infection, due to conditions existing in the trenches, and the character of the fragments projected by the high explosives of the shells. Mills<sup>5</sup> points out that, after ten days or so,

<sup>1</sup> Archives d'ophtalmologie, 1915, vol. xxxiv, p. 745.

<sup>2</sup> Archiv f. Augenheilkunde, 1915, vol. lxxix, p. 29.

<sup>3</sup> La Clinique Ophtalmologique, 1915, vol. xx, p. 642.

<sup>4</sup> Ophthalmic Review, 1915, vol. xxxiv, p. 225.

<sup>5</sup> Transaction Section on Ophthalmology of American Medical Association, 1915, p. 160.

the fragments of a disorganized eyeball become so embedded in an over-growth of conjunctiva as to be indistinguishable. In many cases there is enormous swelling due to infection of the orbital tissues.

While head injuries involving the visual tracts and centres might properly be considered under injuries to the brain, they are nearly always seen and studied by ophthalmologists, and most of them are reported in ophthalmic journals. The proportion of such cases in the present war is unusually large. Such injuries, involving both cortical visual centres of the occipital lobes, cause bilateral blindness, or involving one some form of hemianopsia. But among cases reported are some which do not confirm to types hitherto recognized. Thus Lister mentions cases in which, with complete blindness at first, this gradually cleared up, leaving central scotomas with a full peripheral field. Cantonnet<sup>1</sup> saw a case of hemianopsia in which, contrary to the rule, the blind half of the field extended beyond the fixation point. On the other hand, Wood<sup>2</sup> saw a case of injury to the occipital lobes in which there was full central vision, but the peripheral field was contracted. Probably a collective study of these cases will throw some new light on the representation of different portions of the retina in the visual cortex.

The relation of *papilledema*, or choked disk, to injuries of the vault of the skull has been commented on by Jessop, Birch-Hirschfeld,<sup>3</sup> and others. If a high velocity bullet reached the vault of the cranium, it almost invariably caused fracture. Other cases of fracture without penetrating wound of the skull arose from injuries by shrapnel, shell explosives, etc. Considerable statistics accumulated by different observers show that in more than half of these cases, notable *papilledema* is to be recognized. It is very closely associated with increased intracranial pressure. In 2 cases seen by Lister in which it was asymmetrical the swelling was greater on the side of an extensive cerebral hemorrhage. In the great majority of cases vision was not impaired, and the optic disk became normal without operative interference. If the choking of the disk were progressive, decompression promptly relieved it.

The treatment of war injuries has been very often complicated by delay, lack of apparatus, and severe infection. While the problems to be solved, especially in the direction of cosmetic surgery, were often difficult and complex. The tendency of the conjunctiva to fill in wounds that involved it has been mentioned above. The delay of proper replacement of the parts has caused extreme deformities; and the lack of facilities for Röntgen-ray examination has led to retention of unsuspected foreign bodies, of even large size. Iggersheimer<sup>4</sup> reports a series of cases in which pedicled flaps were employed to rebuild the lids and

<sup>1</sup> Archives d'Ophthalmologie, 1915, vol. xxxiv, p. 582.

<sup>2</sup> Ophthalmic Record, 1915, vol. xxiv, p. 392.

<sup>3</sup> Zeitschrift f. Augenheilkunde, 1915, vol. xxxiii, p. 266.

<sup>4</sup> Klinische Monatsblätter f. Augenheilkunde, 1915, vol. liv, p. 585.

form an orbit capable of retaining an artificial eye. In one case, cartilage was obtained from the ear to replace the tarsus.

**Shock from Contusion of Eye.** Williams<sup>1</sup> has studied the phenomena of shock in 40 cases of contusion of the eye by comparatively small bodies, that could not cause cerebral concussion, or fracture of the skull. In only 1 case was the blow severe enough to rupture the eyeball; and in one-half the cases there was no permanent damage to the internal structure of the eye. But the evidences of shock are much more striking from such injuries, than from blows on other parts. Usually the patient staggered and sank to the ground; remaining there dazed, but conscious. But, in some instances, consciousness was lost for several minutes. Severe pain may come instantly, but is sometimes delayed an hour or more. It may persist for several days. The patient feels faint or chilly, looks pale or haggard, is nauseated, often vomits, and staggers if he attempts to walk. The blood-pressure is low, the pulse weak and rapid. These symptoms generally disappear after a night's sleep; but the patient is often very restless in sleep. Disturbing dreams occurred in 2 cases; and the mental and physical prostration often lasted several days. Such patients sometimes require close attention, rest, at first in bed, and frequent reassurances to prevent the establishment of a traumatic neurosis that may be more permanent.

<sup>1</sup> Trans. American Ophthalmological Society, 1915, p. 402.



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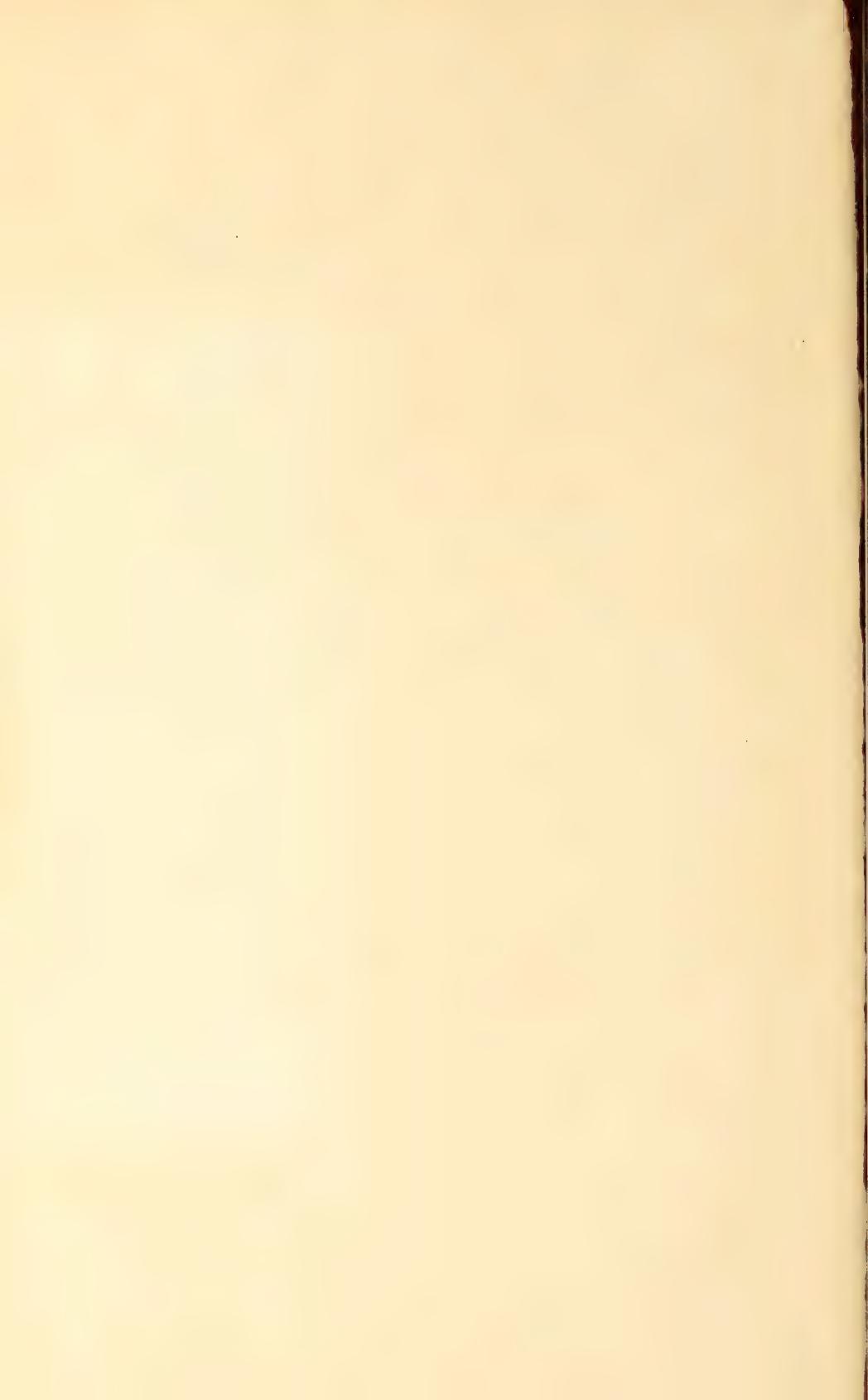
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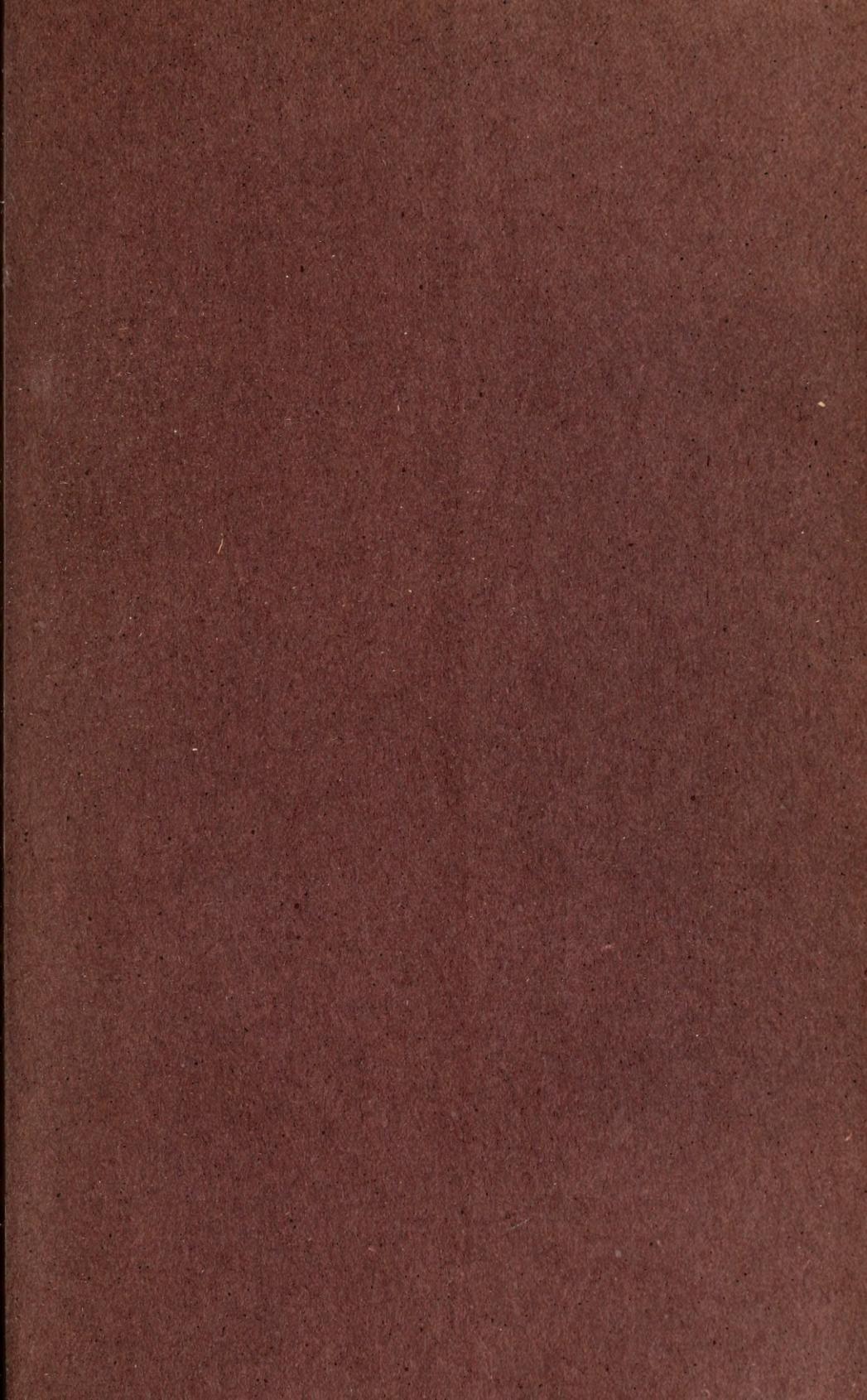
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